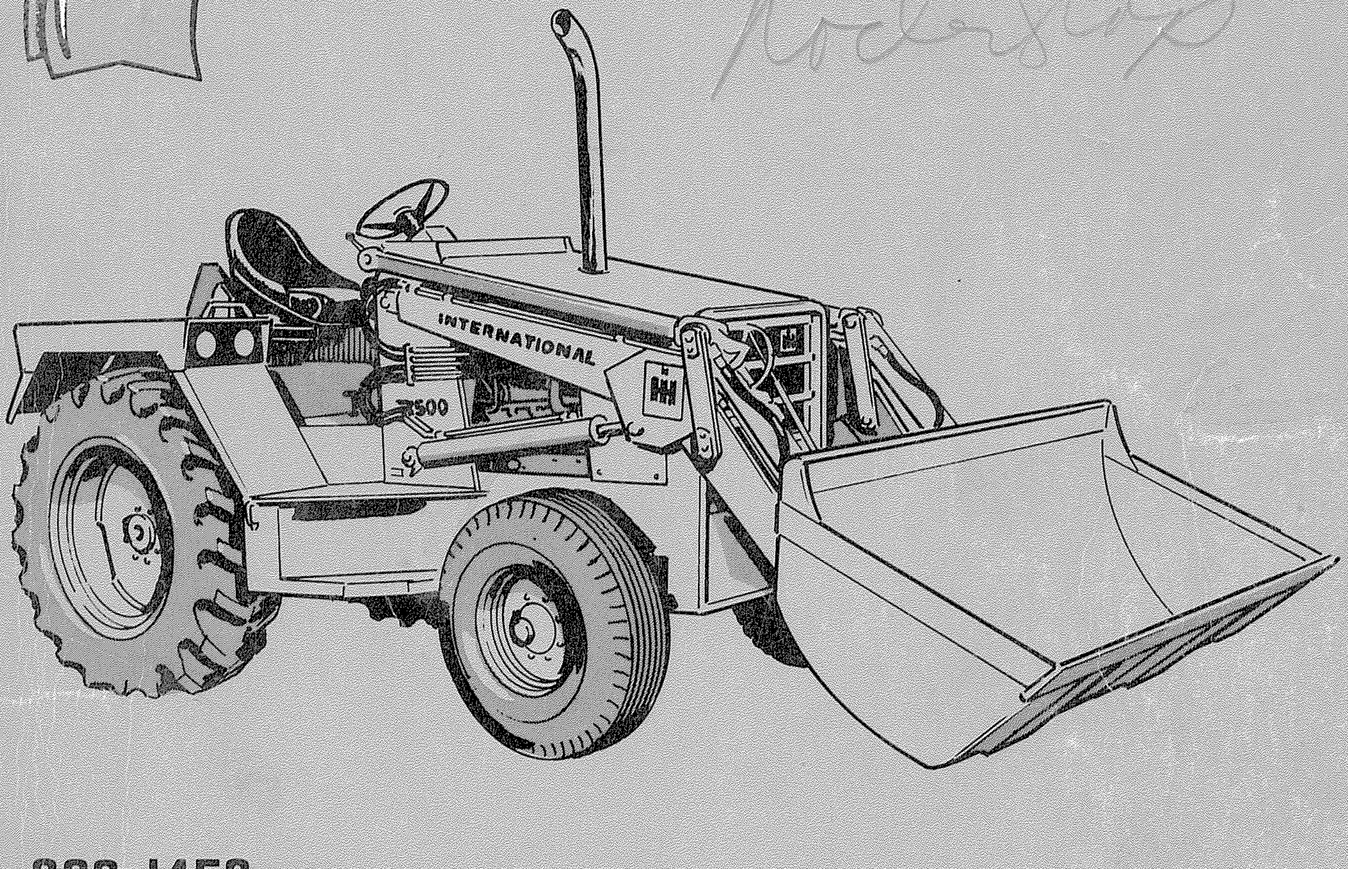
Service Manual

Tractor Shop



GSS-1452

HYDROSTATIC TRANSMISSION
2400, 2500 Series A Tractors and 3400, 3500 Series A Loader Tractors

INTERNATIONAL HARVESTER
AGRICULTURAL/INDUSTRIAL EQUIPMENT
401 NORTH MICHIGAN AVENUE • CHICAGO, ILLINOIS, 60611, U.S.A.

FOREWORD

The instructions and special tools shown in this Blue Ribbon Service Manual are for use by International Harvester Dealers and their factory trained servicemen.

The specifications as listed in this manual are current as of the printing date. Due to changes and improvements in our products, dealers are periodically issued service bulletins to keep this manual up-to-date. We suggest you refer to the most recent information when performing service work on this equipment.

International Harvester Factory Trained servicemen are best qualified to service IH equipment.

Distribute to dealers having the following contract: J-102

IMPORTANT NOTE

Always read each step in its entirety before starting to perform it. Necessarily, some vital information may come at the middle or end of the description of a step. Much time can be saved, and damage to parts avoided, if the procedure is studied before work commences.

LIBRARY FILING INFORMATION

1. File this manual after Divider Tab GSS-1452.
2. Enter the following information in the Service Manual Index. In the following Section, print or preferably type in, the Manual Discription and Form Number.

Tractor Transmission

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SPECIAL SERVICE TOOLS REQUIRED

FES 52	Basic engine stand	
FES 52-1	Engine stand attaching plate	
FES 52-13	Attaching plate	
OTC 515-A	Crossbar	Order from: Service Tools, Inc. 1901 Indiana Ave. Chicago, Ill. 60616
OTC 927	Puller	
OTC 943-E	Puller	
OTC 950	Puller plate	
FES 141	3 to 4 inch depth micrometer	

Gauges required, but not included in Kit FES 123, listed below:

FES 2-81	1/4" male to male union
FES 96-1	Marsh pressure gauge 0-600 psi in increments of 10 psi
FES 96-2	Marsh pressure gauge 0-10,000 psi in increments of 200 psi
2-FES 96-3	1/4" male tube x 1/4" NPT female connector.
FES 123	Hydrostatic tractor tool kit — does not include gauges or FES 96-3 connector listed above which must be obtained. Includes the following:
FES 123-9	Center section surface protectors
FES 123-10	Motor shaft master snap ring
FES 123-11	IPTO shaft master snap ring
FES 2-45	Connector 573 206 R1 (order from parts depot)
FES 2-48	5/8" female swivel 1/2" wire braid hose, 56" long (2 used)
FES 53-1	Return nozzle

Refer to Farm and Industrial Equipment Service Tool Manual, GSS-1251, for source and ordering procedure.

SPECIFICATIONS

PRESSURE:

Charge psi @ 900 rpm .... Instroke .... Neutral
180 psi 240 psi

Servo psi @ 900 rpm .... 390 to 430 psi

Drive psi .... 3400 and 3500 6600 psi high range forward and 6000 psi in reverse

2400 and 2500 series 5500 psi forward, low range 5500 and low range reverse

Deceleration valve pressure .... 2500 to 3100 psi all models

Charge pump............ The approximate pump flow with the oil temperature at 115° degrees F. in neutral forward or reverse is

Engine RPM	Gallons Per Min.
2400	10.8
2000	9.
1500	6.6
1200	4.8
900	3.6

Servo pump cannot be checked - 4 GPM @ rated speed.

SPEED RATIO CHART

Ground Speed at Rated Engine rev/min	Pump Swash Plate Angle*	Motor Swash Plate Angle**	Drive Control Valve Position
Neutral			
Zero Speed	0	-18°	Neutral
Forward			
0 to 3.8 MPH Low Range	0 to -18°	-18°	Forward
3.8 to 7.7 MPH Low Range	-18°	-18° to -9°	Forward
0 to 9.5 MPH High Range	0 to -18°	-18°	Forward
9.5 to 19.2 MPH High Range	-18°	-18° to -9°	Forward
Reverse			
0 to 3.36 Low Range)	0 to + 16°	-18°	Reverse
0 to 8.37 High Range)			

* Pump cylinder retracts to increase Forward speed or reduce Reverse speed when in Reverse. Cylinder extends to decrease Forward speed or increase Reverse speed when in Reverse.

** Cylinder retracts to increase speed, extends to decrease speed.

SPECIAL TORQUE VALUES (Ft. Lbs.)

High pressure relief valve to center section	20
Pump swash plate to servo bolt	40 to 45
Motor swash plate to servo bolt	40 to 45
Pump servo trunnion nut	40 to 45
Motor servo trunnion nut	80 to 90
Servo pressure regulating valve to charge pump	15 to 20
Center Section mounting bolts	110

ADJUSTMENTS

Servo cylinder movable orifice from servo trunnion mounting face	3.430 ± 0.005 in.
Pump input shaft torque with swash plate at zero angle and IPTO gear not installed	6 to 12
Motor output shaft torque with swash plate at minimum angle	8 to 15
Drive control spool minimum movement in both directions	5/8 in. + 1/32 in. - 0

STANDARD TORQUE DATA FOR NUTS AND BOLTS

Recommended torque, in foot pounds, for all Standard Application Nuts and Bolts, provided:

A. All thread surfaces are clean and lubricated with SAE-30 engine oil. (See NOTE.)
B. Joints are rigid, that is, no gaskets or compressible materials are used.
C. When reusing nuts or bolts use minimum torque values.

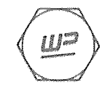
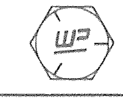
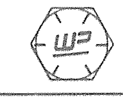
NOTE: Multiply the standard torque by:

.65 when finished jam nuts are used.
.70 when Molykote, white lead or similar mixtures are used as lubricants.
.75 when parkerized bolts or nuts are used.
.85 when cadmium plated bolts or nuts and zinc bolts w/waxed zinc nuts are used.
.90 when hardened surfaces are used under the nut or bolt head.

Bolt or Stud Diameter	Type 1 Studs Only		Type 1 Bolts 6" length or less		Type 1 Bolts longer than 6"		Type 5 (all lengths)		Type 8 (all lengths)			
									Only when used † in cast (gray) iron		All other applications	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1/4	5	6	5	6	3	3	9	10	11	13	12	14
5/16	12	13	12	13	6	7	19	21	24	27	27	30
3/8	21	24	21	24	11	13	33	37	43	47	45	50
7/16	35	38	35	38	19	21	53	60	69	76	75	85
1/2	52	58	52	58	29	32	80	90	104	117	115	130
9/16	70	80	70	80	41	46	115	130	150	170	165	185
5/8	98	110	98	110	57	63	160	180	210	230	220	250
3/4	174	195	174	195	100	112	290	320	350	390	400	450
7/8	300	330	162	181	162	181	420	470	570	630	650	730
1	420	470	250	270	250	270	630	710	850	950	970	1090
1-1/8	600	660	350	380	350	380	850	950	1200	1350	1380	1550
1-1/4	840	940	490	540	490	540	1200	1350	1700	1900	1940	2180
1-3/8	1100	1230	640	710	640	710	1570	1760	2300	2500	2600	2800
1-1/2	1470	1640	850	940	850	940	2000	2300	3000	3300	3300	3700
1-3/4	2350	2450	1330	1490	1330	1490	3300	3700	4700	5200	5300	6000
2	3500	3900	2000	2200	2000	2200	5000	5500	7000	7800	8000	9000

† When bolt penetration is 1-1/2 times the diameter of the bolt.

BOLT TYPE IDENTIFICATION CHART

IH TYPE	S.A.E. GRADE	DESCRIPTION	BOLT HEAD MARKING *
1	Equivalent 1 or 2	WILL HAVE A IH STANDARD MONOGRAM IN THE CENTER OF THE HEAD Low or Medium Carbon Steel Not Heat Treated	
5	5	WILL HAVE A IH AND 3 RADIAL LINES Quenched and Tempered Medium Carbon Steel	
8	8	WILL HAVE A IH AND 6 RADIAL LINES Quenched and Tempered Special Carbon or Alloy Steel	

*The center marking identifies the bolt manufacturer. The IH monogram is currently used. Some bolts may still have an IH or a raised dot which previously identified IH bolts.

STANDARD TORQUE DATA FOR HYDRAULIC TUBES AND FITTINGS

TUBE NUTS				
FOR 37° FLARED FITTINGS				
SIZE	TUBING O.D.	THREAD SIZE	TORQUE - FT. LBS.	
			MIN.	MAX.
4	1/4	7/16-20	10	20
5	5/16	1/2-20	15	25
6	3/8	9/16-18	25	35
8	1/2	3/4-16	40	55
10	5/8	7/8-14	55	75
12	3/4	1-1/16-12	75	95
14	7/8	1-3/16-12	95	115
16	1	1-5/16-12	115	145
20	1-1/4	1-5/8-12	150	180
24	1-1/2	1-7/8-12	200	250
32	2	2-1/2-12	300	350

O-RING BOSS PLUGS	
& SWIVEL NUTS	
JIC - 37° SEAT	
TORQUE - FT. LBS.	
MIN.	MAX.
6	10
10	15
15	20
25	30
35	40
60	70
70	80
80	90
95	115
120	140
250	300

Above torque figures are recommended for plain, cadmium or zinc plated fittings, dry or wet installations.

Swivel nuts either swaged or brazed.

These torques are not recommended for tubes with wall thickness of .035 or less.

GENERAL INTRODUCTION TO TRANSMISSION SERVICING

Whenever a hydrostatic transmission is being disassembled for a serious failure there are a number of general rules which must be followed for satisfactory results.

ABSOLUTE CLEANLINESS AND THOROUGHNESS MUST PREVAIL

A complete disassembly of all components for thorough cleaning during an overhaul is essential. All parts and components as listed below should be disassembled and inspected so that a thorough job of cleaning them can be done and so that all of the necessary parts can be ordered at once.

1. The complete transmission including the hydrostatic pump and motor assemblies.

2. The charge pump.

3. The center section components should all be removed and the center section thoroughly cleaned.

4. The Foot-N-Inch valve.

5. The multi-valve. The minimum and maximum charge regulator valves should be removed as well as the oil cooler bypass valve and the valve body thoroughly cleaned.

6. The servos should be disassembled and inspected and cleaned.

7. The oil cooler should be removed and back-flushed and the oil cooler lines thoroughly cleaned.

The housing after complete disassembly should be steam-cleaned thoroughly and dried.

The range transmission and final drive housings should be flushed out thoroughly.

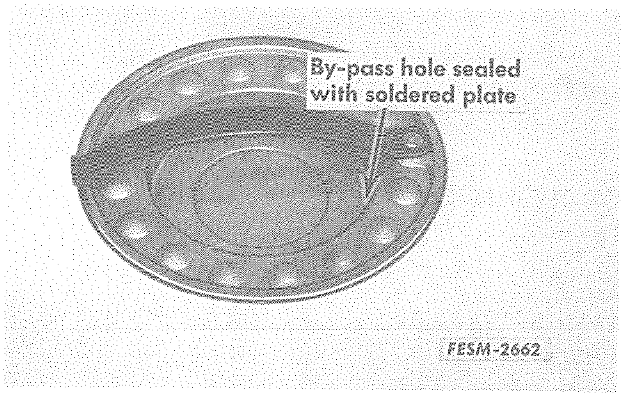
After the transmission is completely drained, it must be filled with 5 gallons of Hy-Tran before start up.

Handling of Parts

The hydrostatic sealing surfaces on the pump and motor block, bearing and valve plates, center section faces and slippers are finished to an extremely high degree and must be free of burrs and nicks or foreign material.

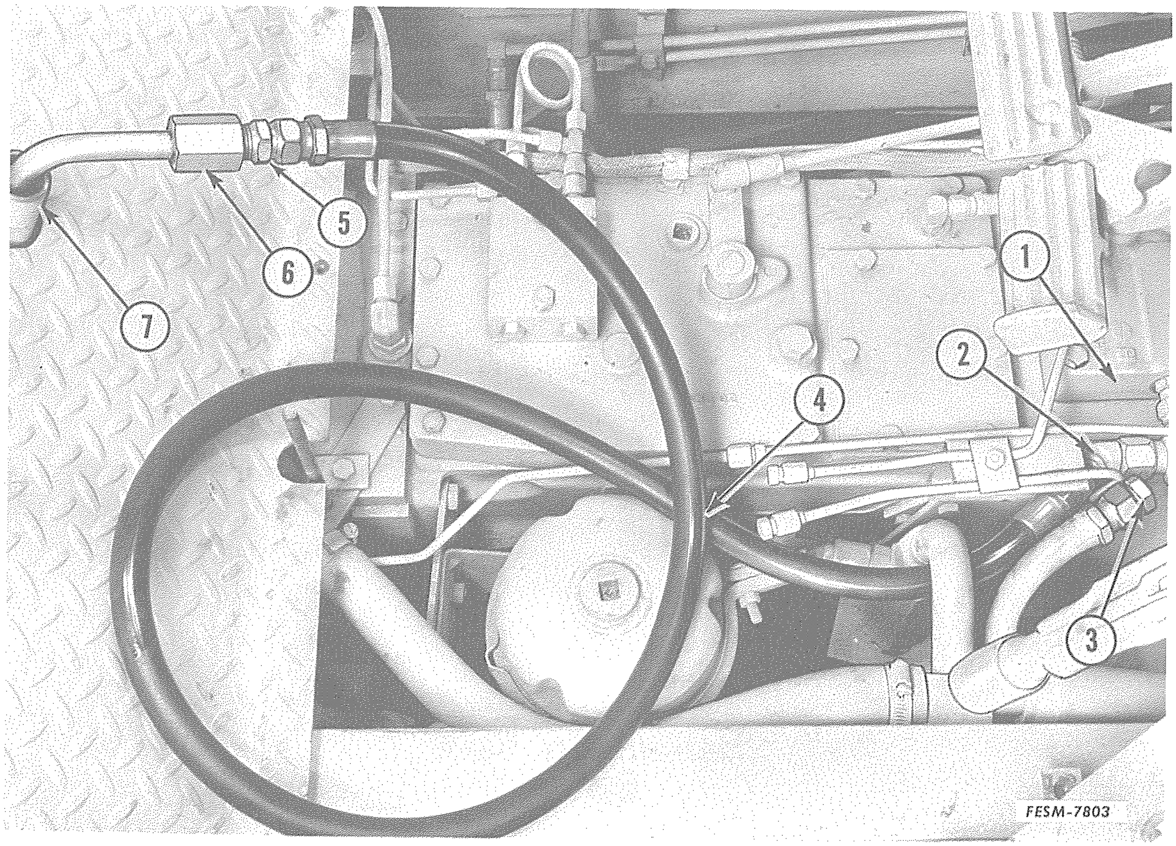
When disassembling, wrap all plates and bearings with clean paper so that they will not be marred when coming in contact with other parts. Wash thoroughly in clean diesel fuel and oil liberally with Hy-Tran during reassembly. All preservative coating must be washed off of new service parts.

Clean Up Procedure



FESM-2662

A dummy by-pass valve should be installed in the final drive filter and the transmission filter and tractor operated for 2 hours with new filters installed. After 2 hours of operating with the tractor wheels off the ground and the wheels rotating alternately in forward and reverse and operating all of the hydraulic components, remove the filters and dummy by-pass valves and install new filters. After 10 hours of service the transmission filter should be replaced and then go to the 100 and 250 hour intervals.

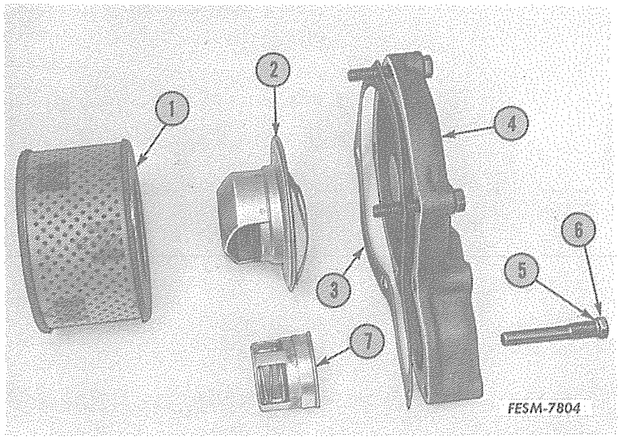


FESM-7803

1. Multi-Valve
2. Tee
3. Capped line
4. FES 2-48 hose assembly
5. FES 53-9
6. FES 53-1 1/2" return nozzle
7. Filler tube

DISASSEMBLY OF TRANSMISSION

Hydrostatic Filter



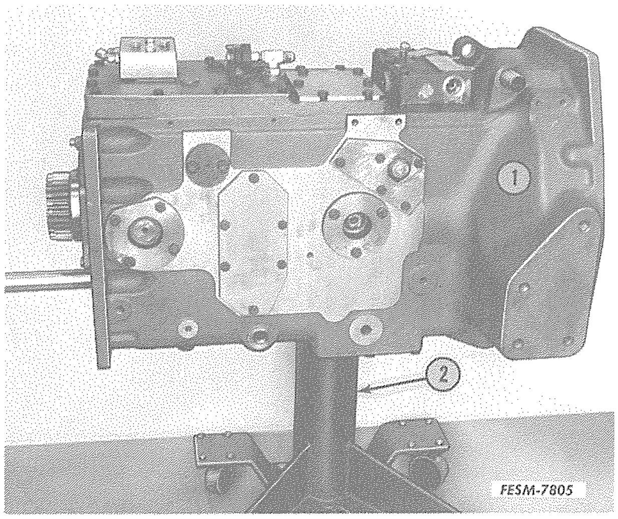
Before removing filter cover back out the check valve shut off bolt 3/8" so check valve can seat. This prevents the loss of oil from the transmission during filter change.

1. Hydrostatic filter
2. Filter by-pass valve
3. Gasket
4. Filter cover
5. O-ring
6. Valve shut-off bolt
7. Filter shut-off valve Assembly

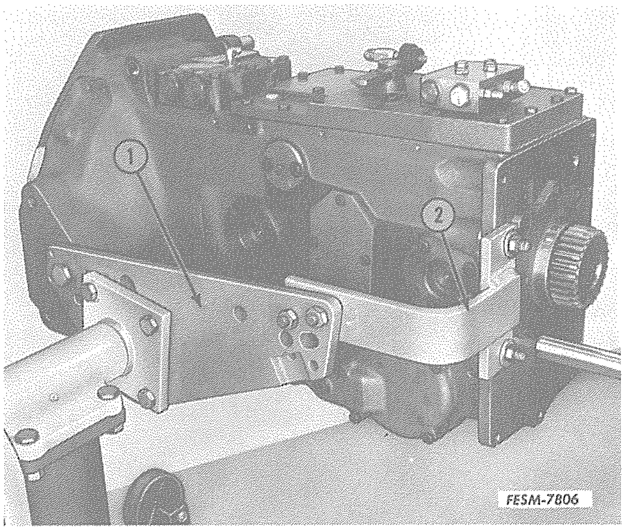
Transmission

1. Mount the transmission on engine stand using the adapter plate FES 52-1 and attaching plate FES 52-13.

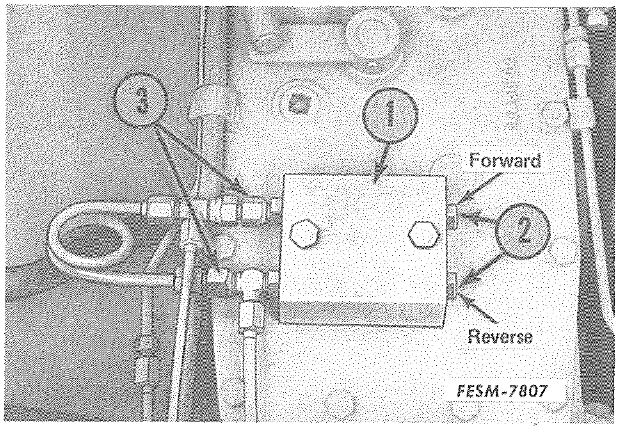
NOTE: An engine stand is necessary.



1. Transmission
2. FES-52 engine stand



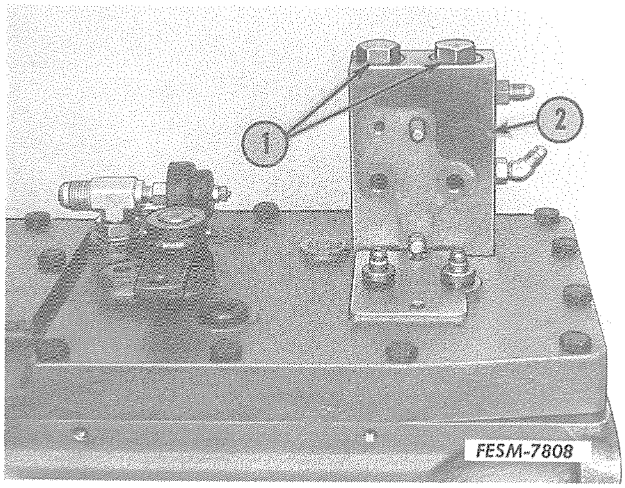
1. Adapter plate FES-52-1
2. Attaching plate FES 52-13



FESM-7807

2. Remove pilot relief manifold. The 3400 and 3500 series tractors have internal in-line check valves.

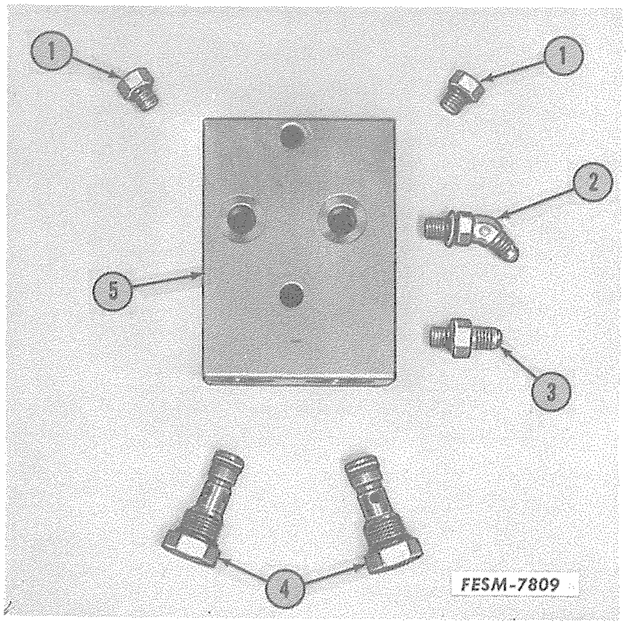
1. Block
2. Test ports
3. External check valve



FESM-7808

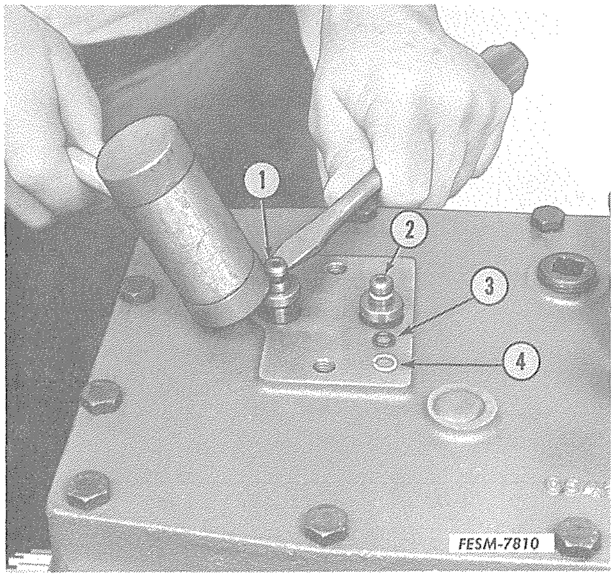
Check valve manifold used in the 2400 and 2500 series tractors has internal check valves. These valves are identical in appearance and can be used in either port.

1. Check valves
2. Block



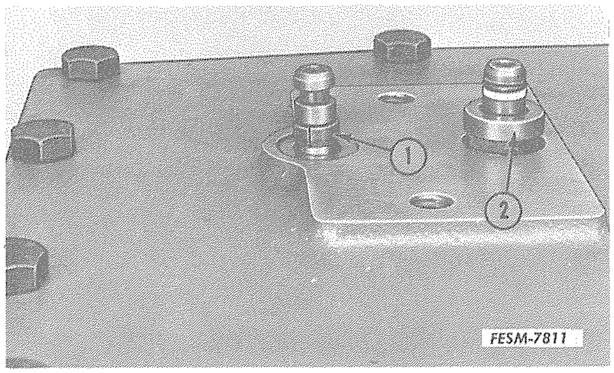
FESM-7809

1. Plugs
2. Forward line
3. Revers line
4. Internal check valves
5. Block

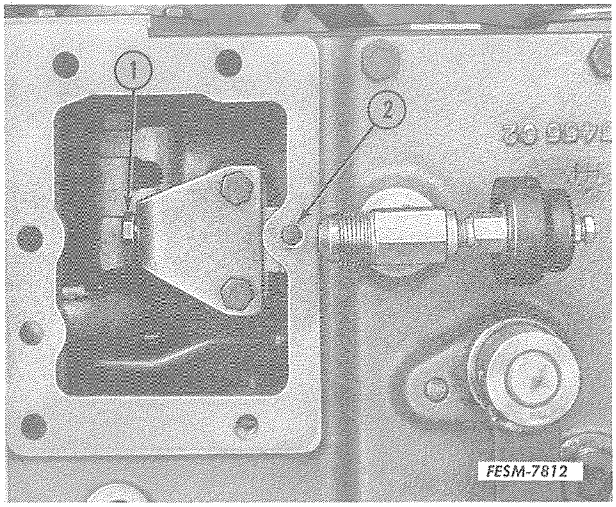


3. Remove teflon back-up rings and O-rings from the high pressure lines. Support the high pressure line with a screw driver and tap down the tube locks so they can be freed for removal.

1. Reverse high pressure line
2. Forward high pressure line
3. O-ring
4. Back up ring



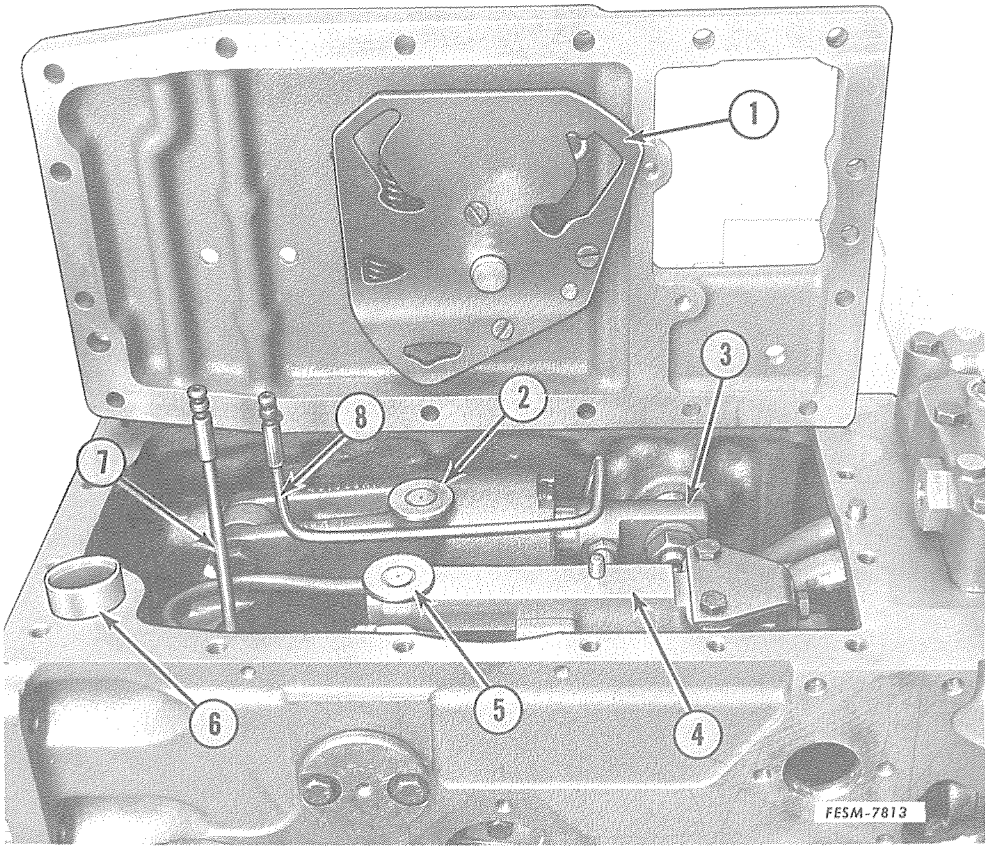
1. Tube locks
2. Tube lock retainers



1. Adjusting block bolt
2. Location of short cap screw

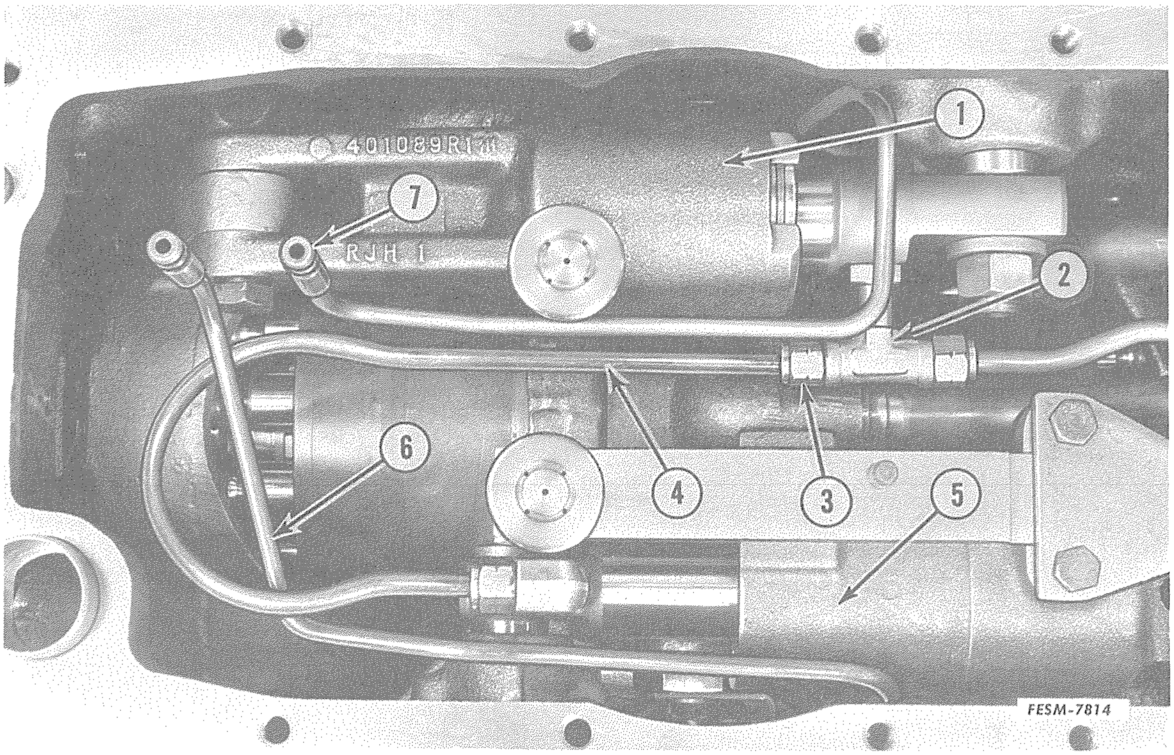
4. Remove servo access cover.

IMPORTANT: Notice copper washers and length of capscrews. Damage to control cam is possible if incorrect placement of capscrews are made.



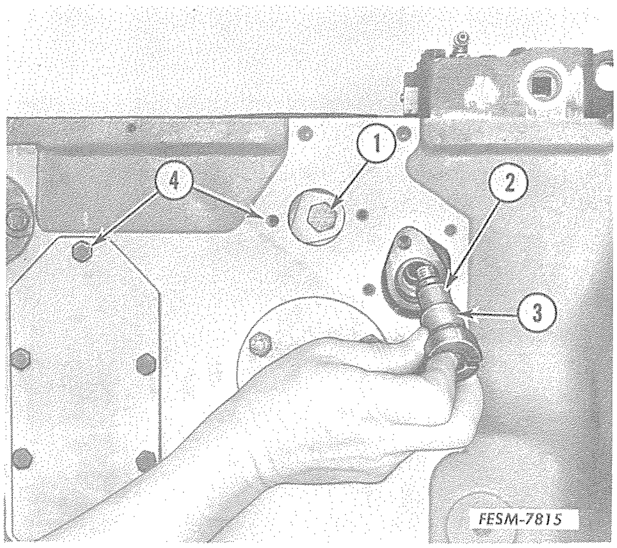
1. Control cam assembly
2. Motor cylinder control orifice
3. Motor servo cylinder
4. Adjusting block
5. Pump cylinder control orifice
6. Over flow pipe
7. Reverse high pressure tube
8. Forward high pressure tube

5. Remove top cover and control cam assembly.



1. Motor servo cylinder
2. Motor servo supply tee
3. Tube assembly nut
4. Pump servo supply tube
5. Pump servo cylinder
6. Reverse high pressure tube
7. Forward high pressure tube

6. Remove pump servo supply tube.



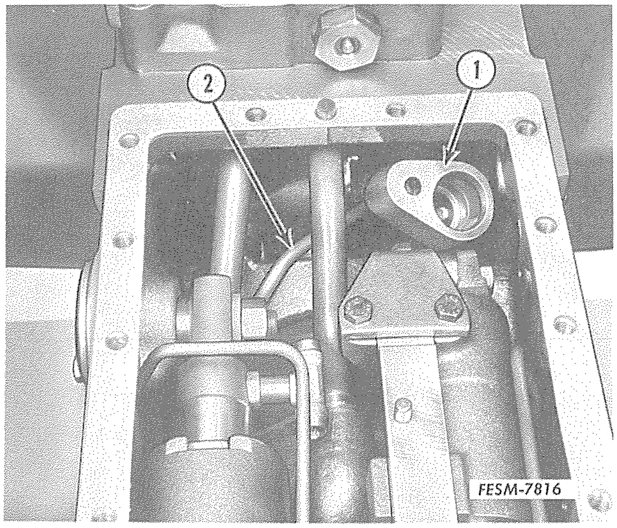
7. Remove pressure check cover assembly.

NOTE: Copper washer.

8. Remove servo regulator valve using a tie-rod end tool.

1. Pump servo shoulder bolt
2. Pressure regulator valve assembly
3. Regulator valve strainer screen
4. Location of copper washers

9. Disconnect servo supply tube at tee.



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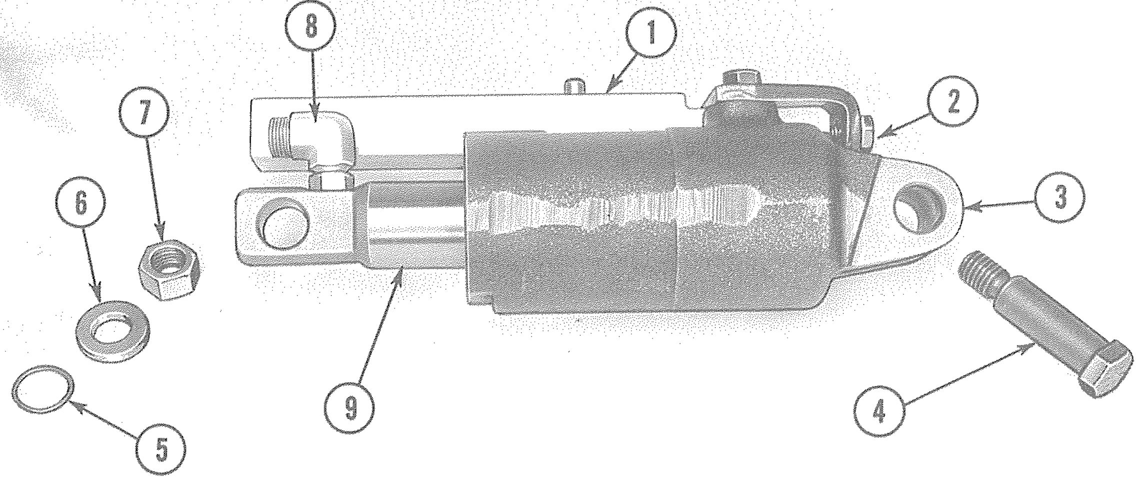
10. Remove servo regulator body and motor servo supply tube as an assembly by retracting the pump servo cylinder (Pushing it to the rear.)

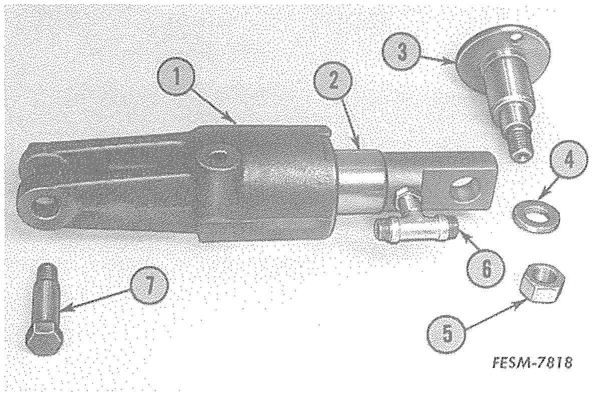
1. Servo regulator valve housing
2. Motor servo supply tube assembly



FESM-7817

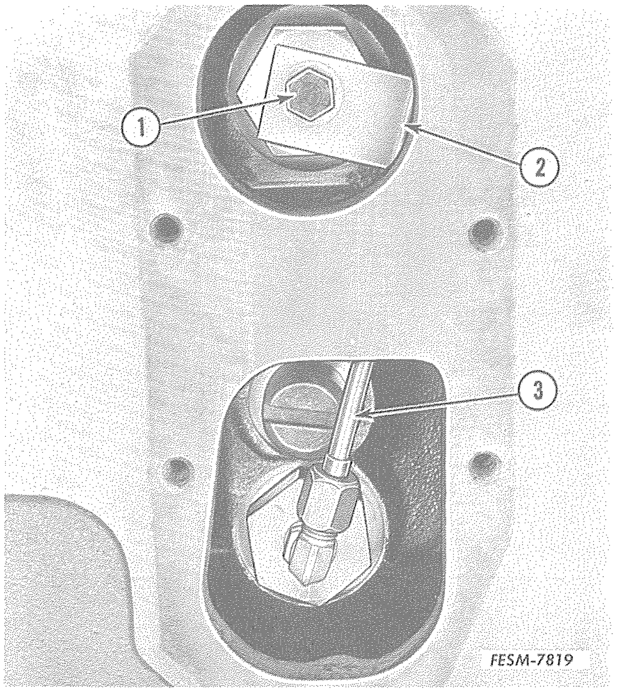
1. Variable orifice adjusting block assembly
2. Adjusting block bolt
3. Body
4. Shoulder bolt
5. Spring washer
6. Washer
7. Nut
8. Elbow
9. Piston

11. Remove the pump servo by disconnecting it at the swash plate and rear anchor trunnion.



12. Remove motor servo by removing swash plate anchor bolt, anchor trunnion nut and servo anchor trunnion.

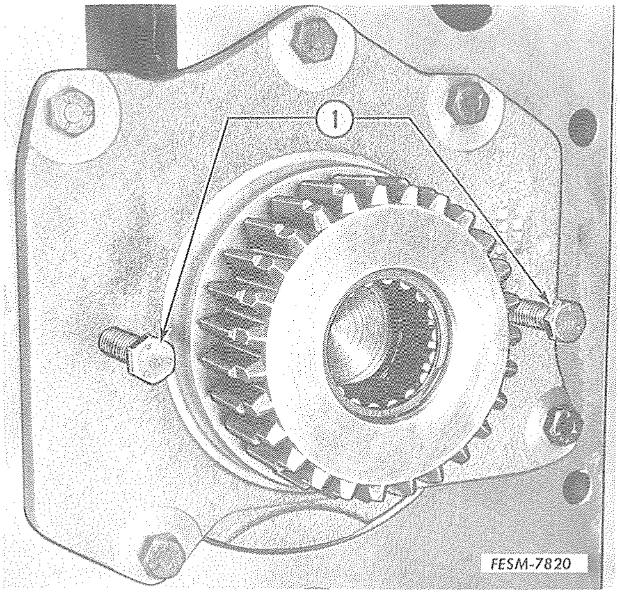
1. Cylinder body
2. Piston
3. Motor servo trunnion
4. Motor servo trunnion washer
5. Nut
6. Tee
7. Shoulder bolt



13. Remove servo anchor trunnions, noting shims under right-hand anchor trunnion.

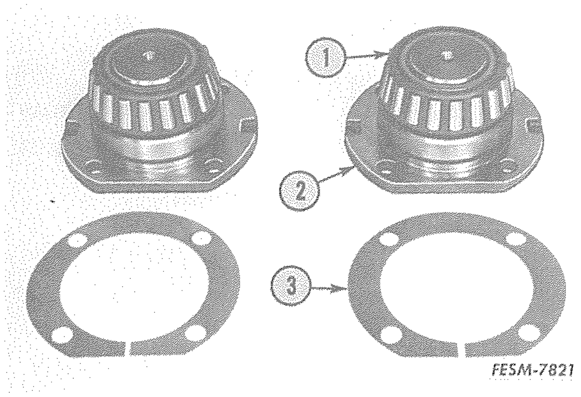
14. Remove both R.H. and L.H. relief valve access covers. Remove cap screws retaining the high pressure lines to both relief valves and remove lines.

1. Cap screw
2. Clip
3. Reverse high pressure tube



15. In order to remove motor assembly it is necessary to releave the load on the trunnions by installing two special 3/8" x 3" NC Allen head set screws or as illustrated two 3/8" x 3" NC cap screws.

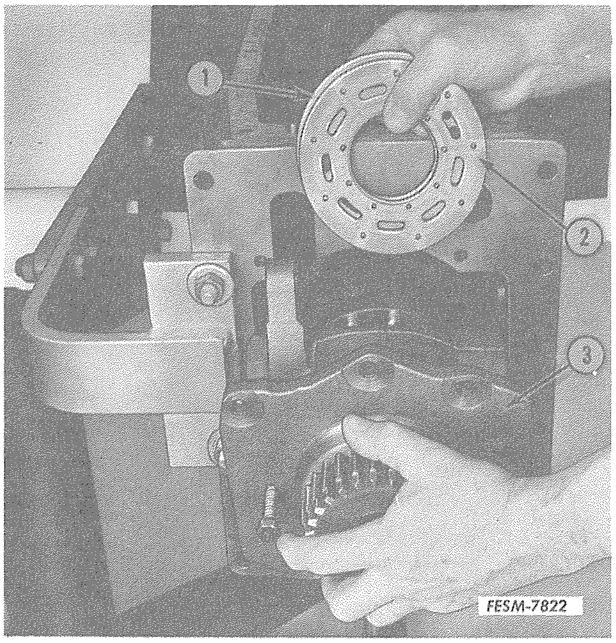
1. Two 3/8" x 3" NC capscrews



16. Remove motor trunnions cap screws and remove trunnions with bearings by using a screwdriver in slot provided.

NOTE: Retain shims with trunnions.

1. Motor trunnion cup bearing
2. Motor trunnion
3. Shim

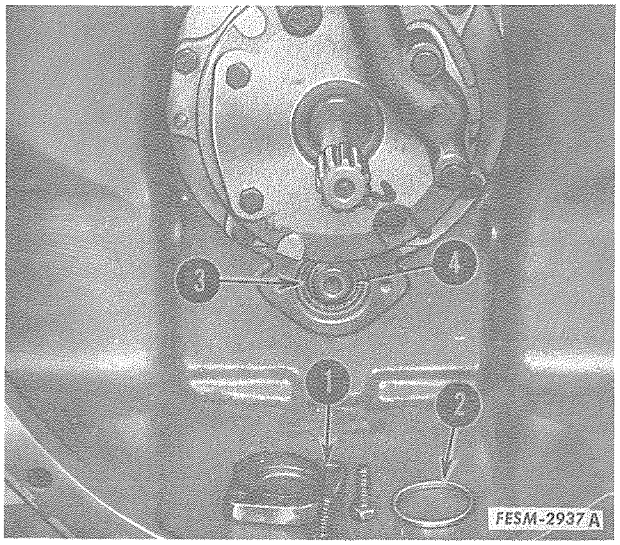


17. Remove rear housing and motor assembly mounting bolts and remove housing assembly.

CAUTION: Remove the assembly, being very careful not to drop either the bearing plate (brass plate) or valve plate (steel plate). Wrap in clean paper and set aside where they won't be damaged.

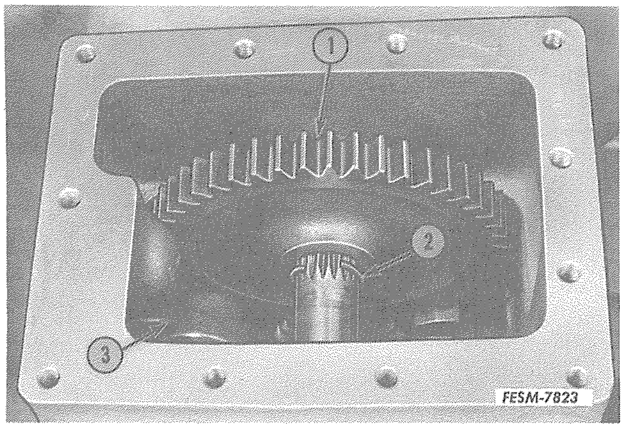
1. Valve plate
2. Bearing plate
3. Rear bearing housing and motor assembly

Removal of IPTO Shaft



1. Remove the IPTO front bearing retainer and remove the O-ring, spacer and snap ring.

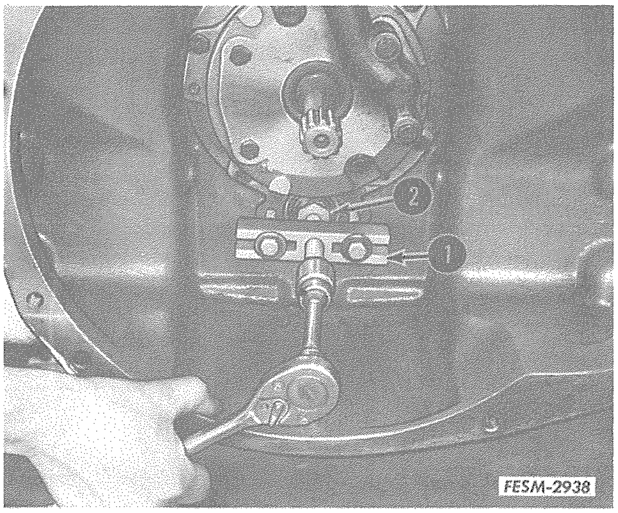
1. IPTO bearing retainer
2. IPTO bearing spacer
3. IPTO front bearing
4. Snap ring



1. IPTO driven gear
2. Snap ring
3. Suction tube manifold

2. Remove bottom cover.

IMPORTANT: IPTO driven gear must not be allowed to follow the shaft back or it will damage the cast suction tube manifold. Remove gear retaining ring from its groove so tension can be relieved to aid in removing the front snap ring. Before removing IPTO shaft, be sure to remove the gear retaining ring so damage to the lip shaft seal will not be encountered.



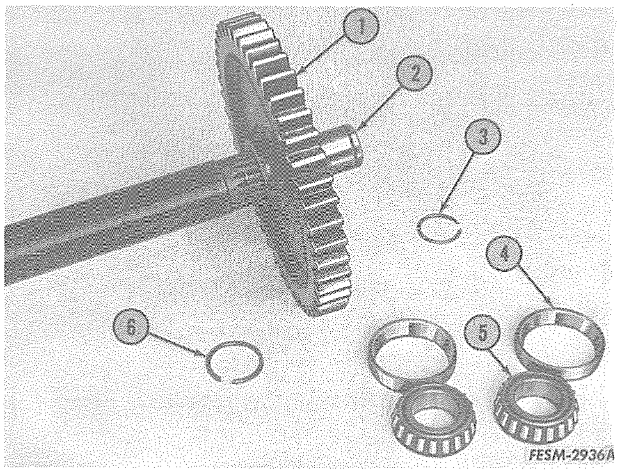
3. Use OTC puller No. 515-A with two 3/8" x 2" NC capscrews and step plate as illustrated.

1. O.T.C. crossbar 515-A with two 3/8" x 2" NC capscrews
2. Step plate

4. Push shaft to the rear.

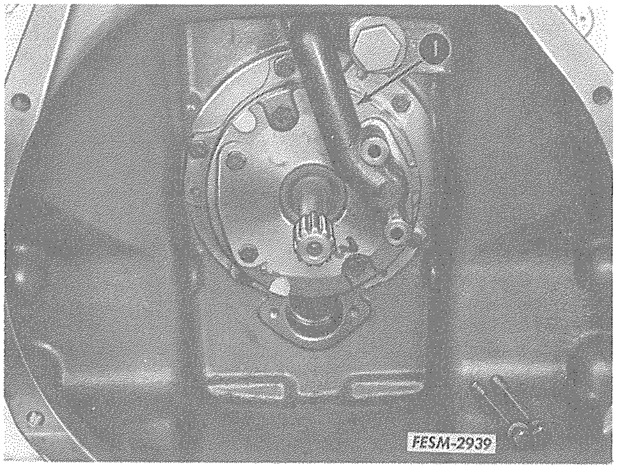
CAUTION: Do not drop bearing cone assembly, bearing cup or gear when removing.

5. Remove gear retaining ring before removing the IPTO shaft or damage to the lip shaft seal will be encountered.



1. Gear
2. IPTO front driven shaft
3. Bearing retaining shaft ring
4. Bearing cup
5. Bearing cone assembly
6. Gear retaining ring

Charge and Servo Pump

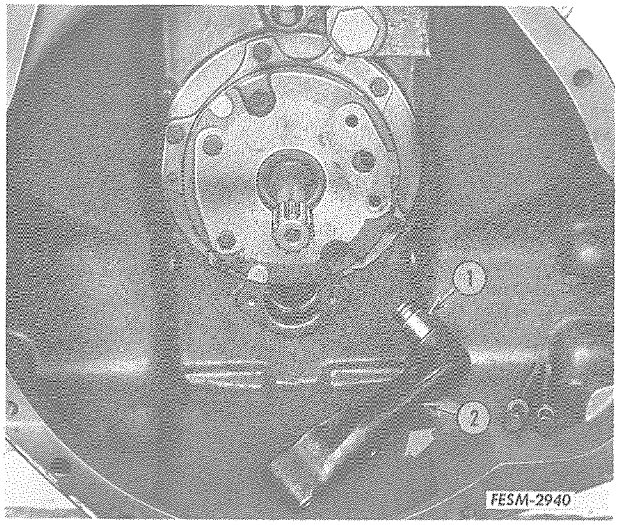


1. Remove charge pump manifold.

NOTE: Copper washers on both capscrews.

IMPORTANT: Anytime a charge pump is replaced for failure, the entire transmission should be disassembled and cleaned up and the input shaft bearings adjusted. For removal it is necessary to make a front end split.

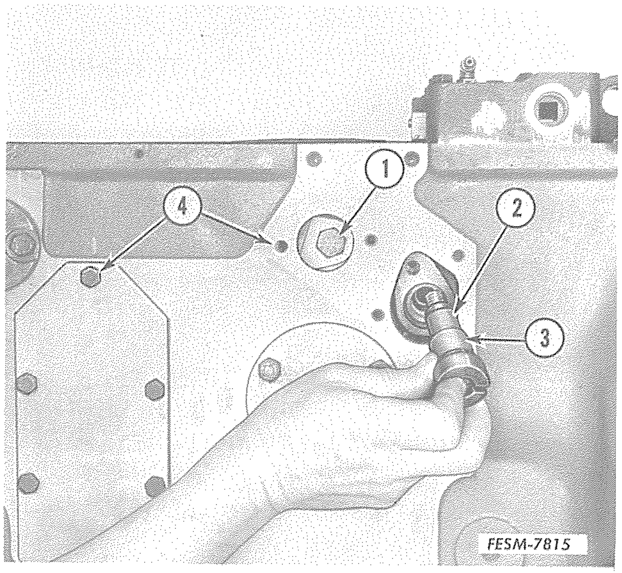
1. Charge pump manifold



2. Remove charge pump.

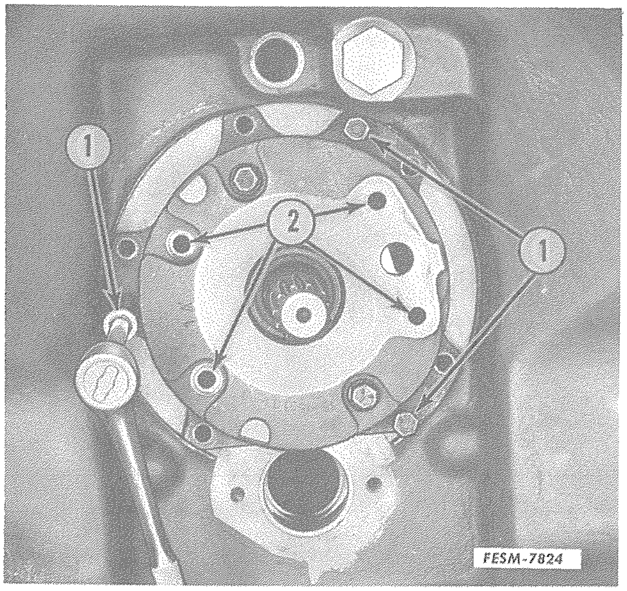
NOTE: Capscrews and copper washers. Remove the two opposite capscrews. These capscrews secure the suction pipe elbow to the back of the charge pump.

1. Charge pump jumper tube
2. Charge pump manifold



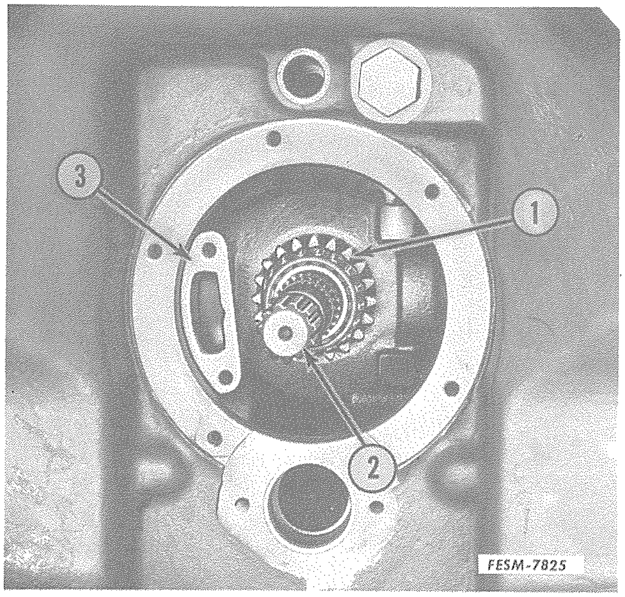
IMPORTANT: Remove servo regulator valve if it has not been removed.

1. Pump servo shoulder bolt
2. Pressure regulator valve assembly
3. Regulator valve strainer screen
4. Location of copper washers



3. Remove capscrews securing the charge pump and remove pump using three of the five capscrews as jackscrews.

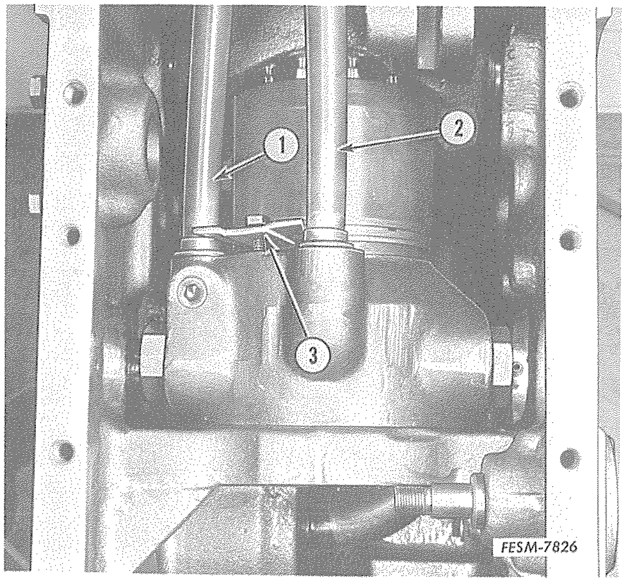
1. Jackscrews
2. Copper washers



4. Illustration shows input shaft with charge pump removed.

NOTE: Suction pipe elbow.

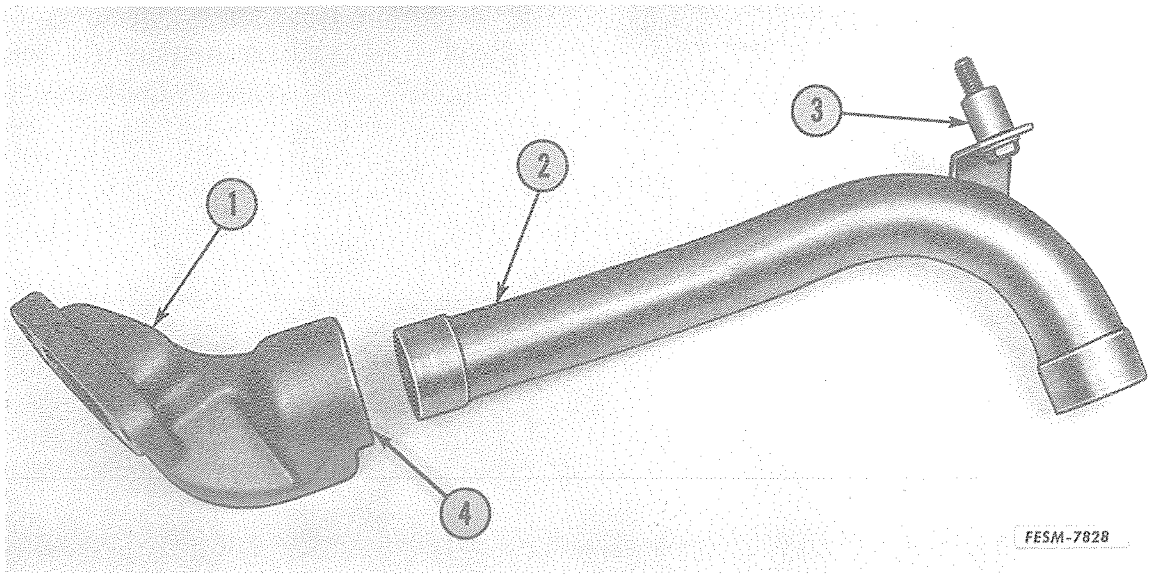
1. IPTO drive gear
2. Input shaft
3. Suction pipe elbow



5. Remove the center section charge tube by first removing center section pipe retainer. With screwdriver against tab provided, on the charge tube, tap forward and rotate tube to remove it.

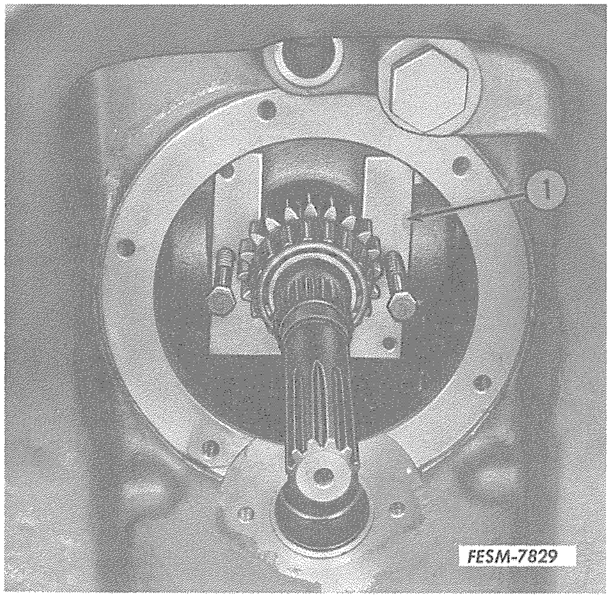
6. Using a rubber malet tap center section exhaust tube forward far enough so tube can be turned towards the housing to be removed.

1. Center section exhaust tube
2. Center section charge tube
3. Center section pipe retainer



1. Suction pipe elbow
2. Suction tube assembly
3. Suction pipe support spacer and capscrew
4. O-ring

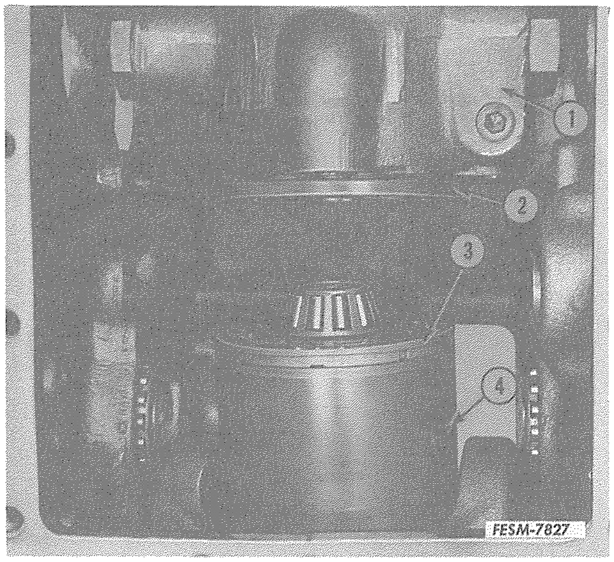
7. Remove capscrew with spacer and push suction tube into hydrostatic filter compartment. Remove suction pipe elbow first and then the suction tube assembly.



8. Install the horseshoe tool FES 123-3 and adjust the adjusting bolts to relieve the pressure on the trunnions. When removing trunnions be sure each shim pack stays with the trunnions. Lower the pump assembly so it will rest on case.

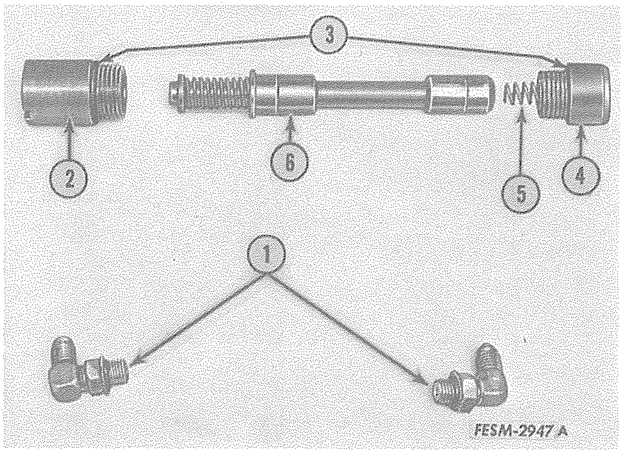
1. FES 123-3 tool

CAUTION: Remove bearing and valve plates from pump assembly and wrap them separately and set aside before removing the center section.



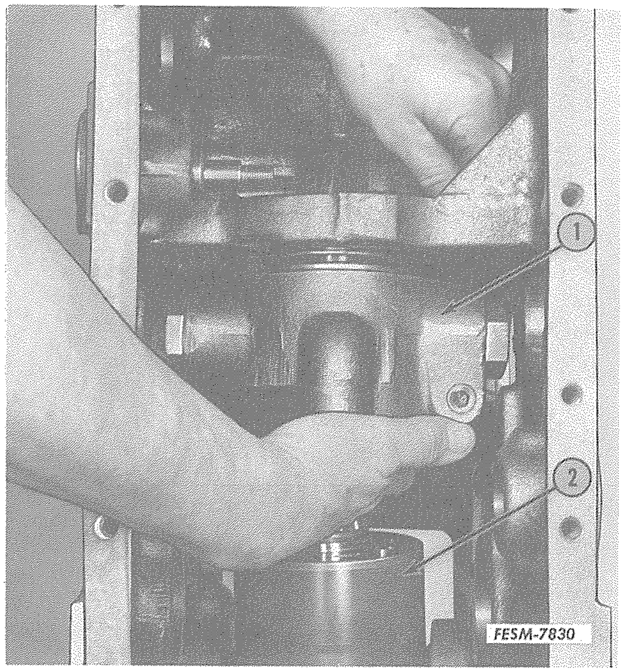
1. Center section
2. Valve plate
3. Bearing plate
4. Hydrostatic pump

9. Remove both high pressure relief valves elbow fittings, and shuttle valve cap for additional clearance when removing the center section.



1. High pressure relief valve fitting
2. Shuttle valve spring retainer plug
3. O-rings
4. Shuttle valve spring plug assembly
5. Shuttle valve centering spring
6. Center section shuttle valve

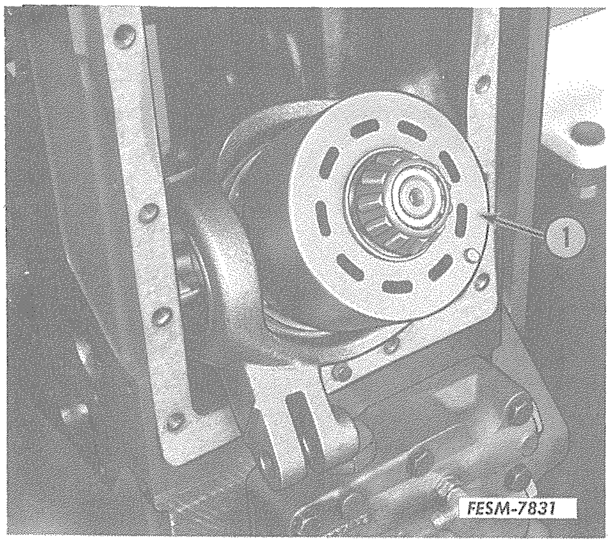
10. Remove shuttle valve spring retainer plug and remove shuttle valve spool. Wrap it carefully in paper to prevent it from being damaged and set aside.


1
2
FESM-7830

11. Remove center section by removing 2 bolts securing the center section to the housing.

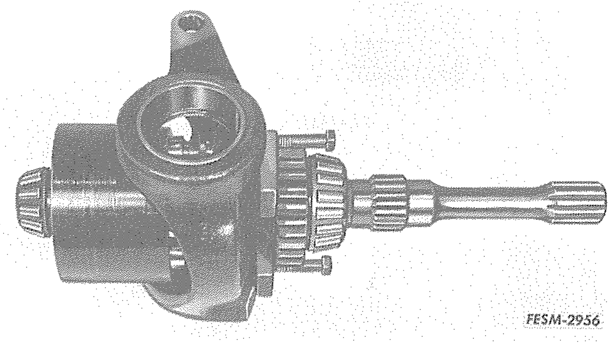
NOTE: Be sure the two high pressure relief valve elbows are removed for clearance.

1. Center section
2. Pump assembly



12. Remove pump assembly as shown in illustration.

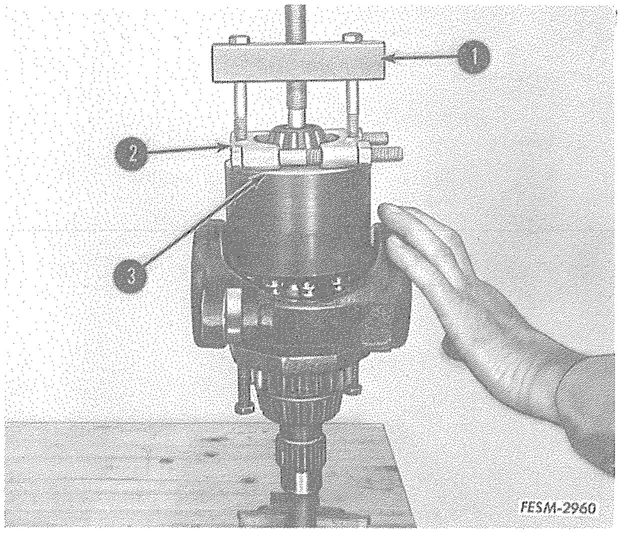
1. Pump assembly



Pump assembly removed.

REMOVAL AND SERVICING OF HYDROSTATIC COMPONENTS

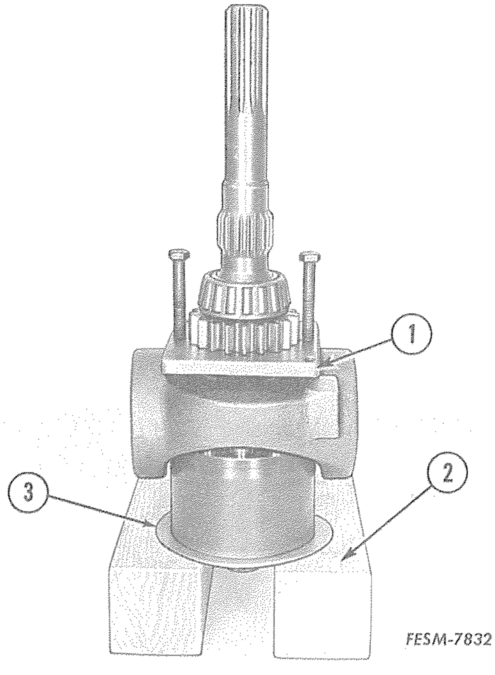
Hydrostatic Pump



1. OTC 515A cross bar
2. OTC 950 puller plate
3. FES 123-9 center section surface protector

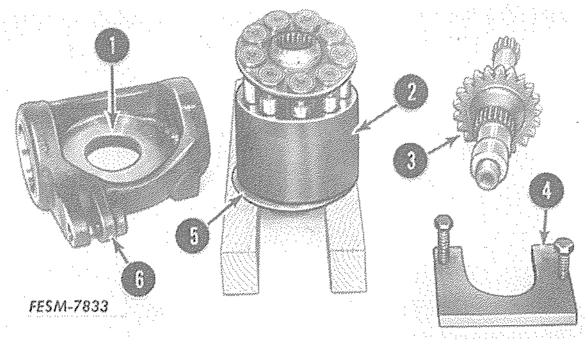
1. Use a protective cover with the raised portion of the center cut out and use OTC puller 515-A and OTC 950 and pull the rear pump shaft bearing cone.

CAUTION: DO NOT TIGHTEN THE SCREW PLATE WITH A WRENCH AS IT IS VERY EASY TO CRUSH THE SPRING GUIDE UNDER THE BEARING. FINGER TIGHT ON THE ADJUSTING SCREWS IS SUFFICIENT. MAKE CERTAIN THAT THE BEARING CAN TURN AS IT IS BEING PULLED.



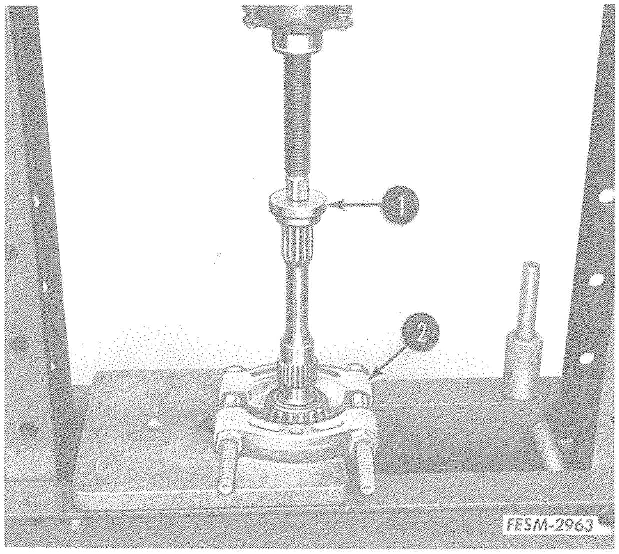
2. Invert the pump assembly and place it with the protector on wooden blocks.

1. FES 123-3 tool
2. Wooden blocks
3. FES 123-9 center section surface protector



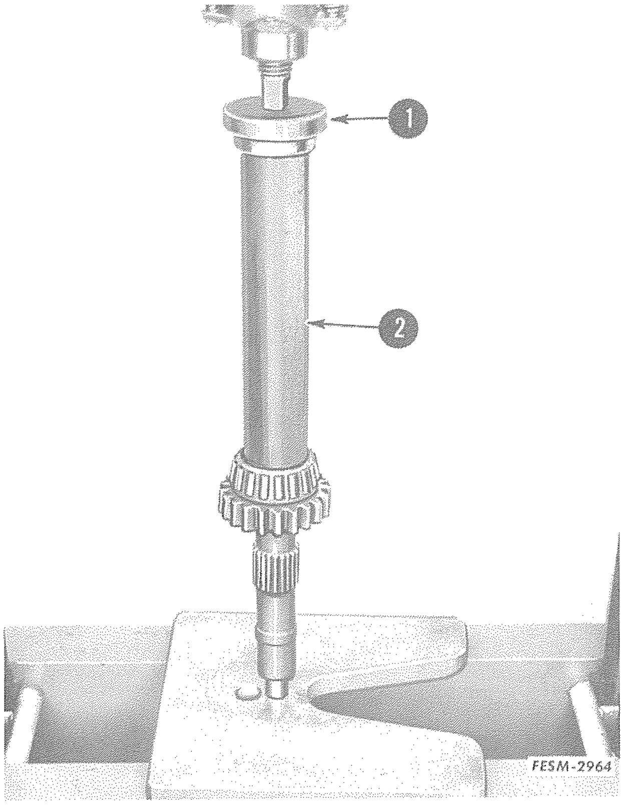
1. Thrust plate
2. Pump cylinder block
3. Input shaft
4. FES 123-3 horseshoe tool
5. FES 123-9 center section surface protector
6. Pump swash plate housing

3. Remove the pump shaft, horseshoe tool and swash plate.



1. Step plate
2. OTC 951 puller

4. If the front pump shaft bearing is to be removed, use puller.



1. Step plate
2. Pipe 1-5/8 I.D. x
   1-7/8 O.D. x 9" long

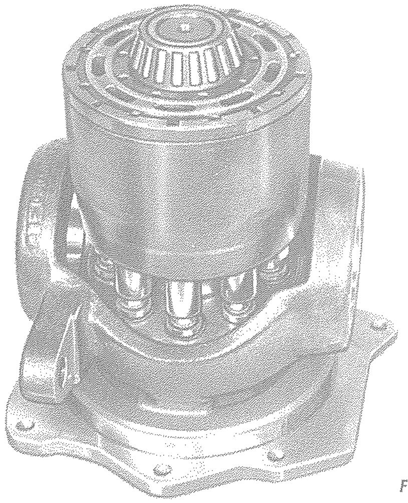
5. When replacing the bearing be sure that it is well seated against the shoulder.

Cleaning, Inspection and Repair

Care of handling and cleanliness of these parts is very important. The slippers, thrust plates in the swash plates, cylinder block surfaces, center section surfaces and the valve and bearing plates all must be free of scratches, nicks or foreign material. They seal and hold high pressure merely by having highly finished surfaces and by being held together tightly by the pressure they are developing. They operate on a film of oil and the pressure being developed furnishes high pressure lubrication.

Replace any questionable parts. Wash all parts in clean diesel fuel and oil liberally with Hy-Tran. Wrap each part in clean paper of lint free cloth unless reassembling at once.

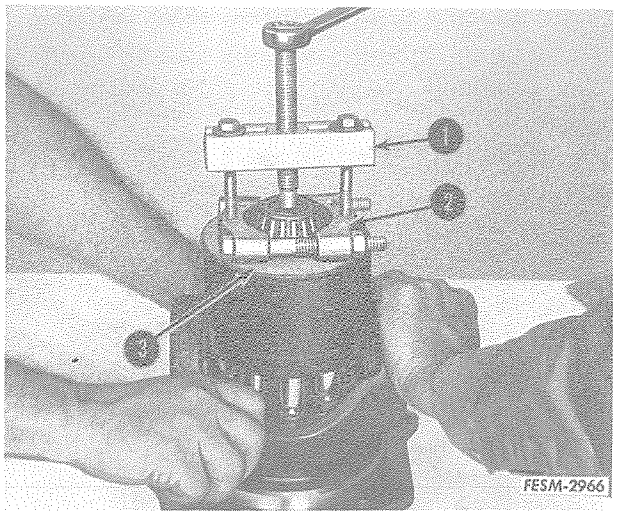
Hydrostatic Motor



FESM-2965

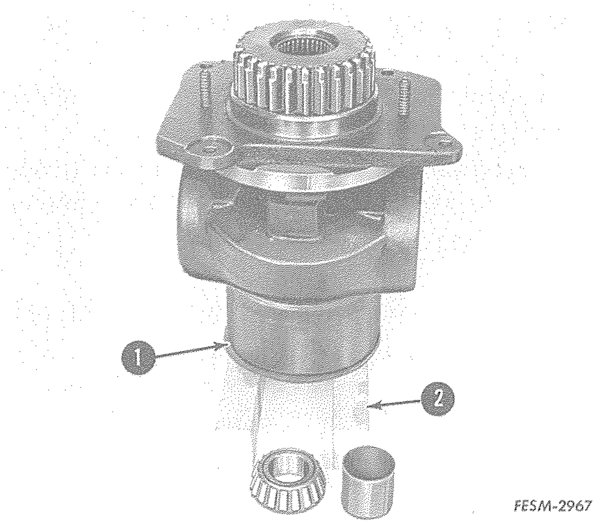
Cleaning, Inspection and Repair

Same as information given above.



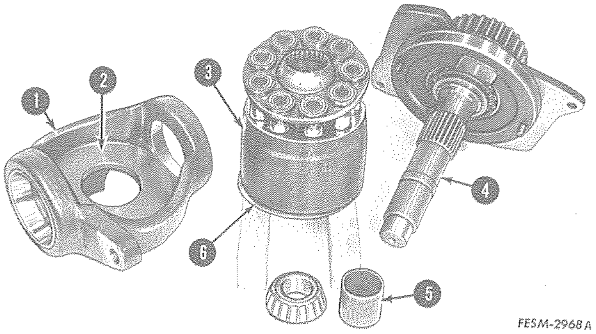
1. Remove the front bearing cone. Use the protective cover on the highly machined surface.

1. OTC 515A cross bar
2. OTC 950 puller plate
3. FES 123-9 center section surface protector



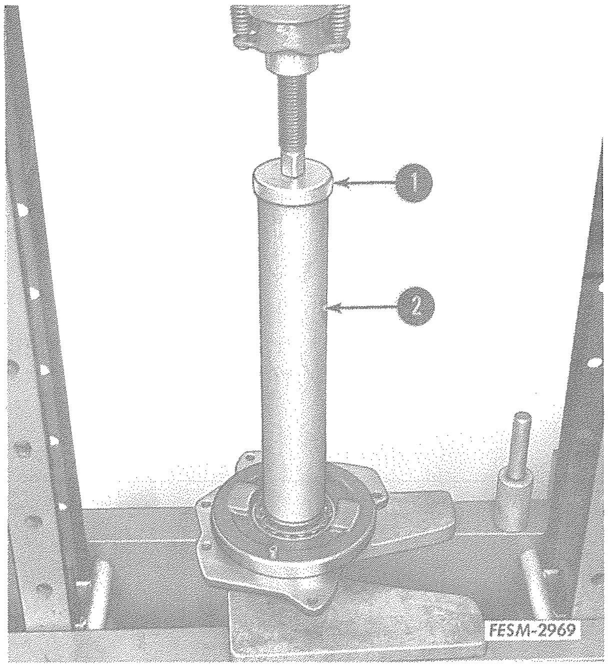
2. Position the motor assembly on wooden blocks. Be sure FES 123-9 is used to protect the machined surface of the motor assembly. In this position the motor assembly can be disassembled without damaging components parts.

1. FES 123-9 center section surface protector
2. Wood blocks



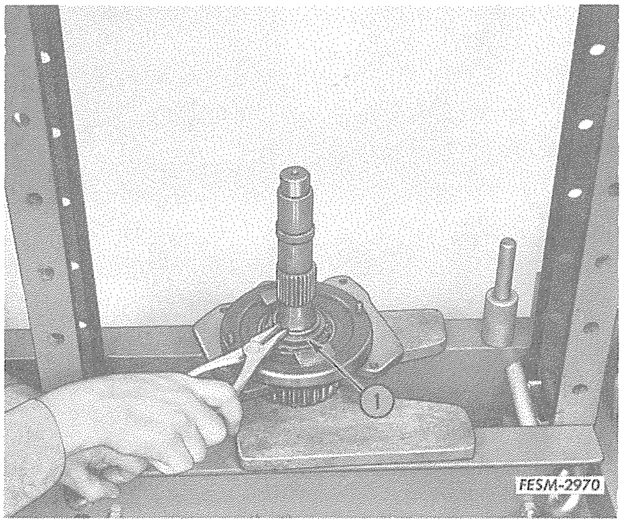
3. Disassemble the motor assembly by removing the output shaft and motor swash plate housing.

1. Motor swash plate housing
2. Thrust plate
3. Motor cylinder block
4. Output shaft
5. Spring guide
6. FES 123-9 surface protector



1. Step plate
2. Pipe 2-3/8 I.D. x 13-1/2" long

4. To remove the bearing retaining ring, use a pipe and press against the inner race of the bearing cone until it moves slightly relieving the ring.

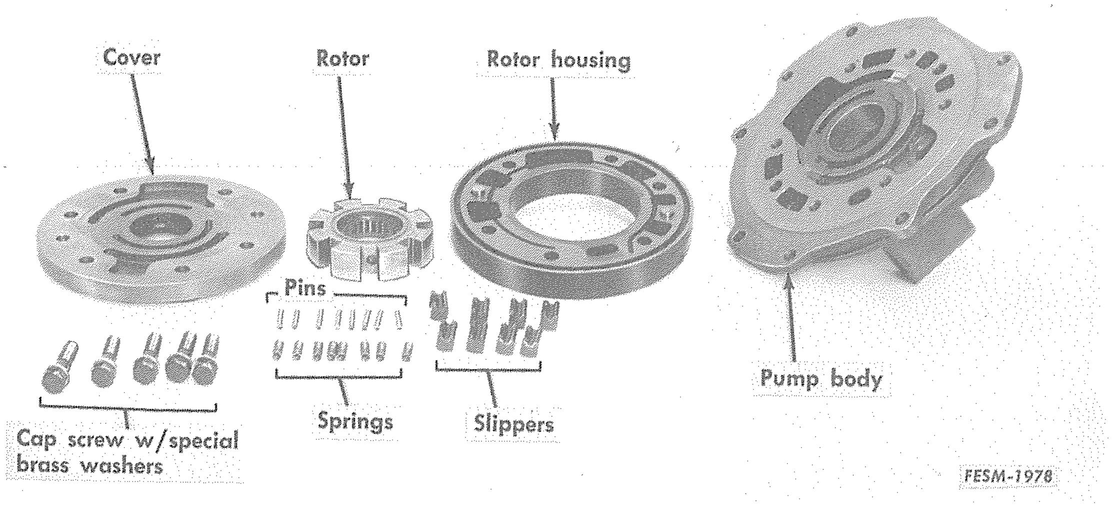


1. Bearing retaining ring

5. Remove the bearing retaining ring. The rear bearing is now free to be removed.

Charge Pump

Disassembly


Cover
Rotor
Rotor housing
Pins
Springs
Slippers
Cap screw w/special brass washers
Pump body
FESM-1978

Charge pump disassembled.

1. Remove the charge pump cover retaining capscrews.

2. Remove the cover while holding the rotor down through the shaft hole. The cover is doweled. If it is not held down the rotor may come out with the cover and the slippers, springs and pins will be dropped.

3. Remove the rotor, slippers, pins and springs.

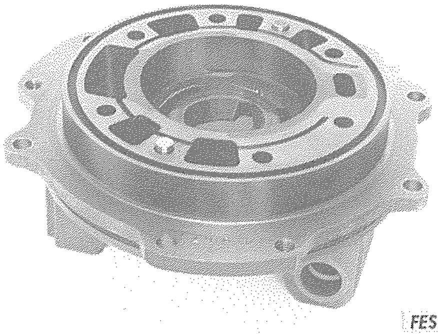
4. Remove the rotor housing. It is doweled to the pump body.

Inspection

The rotor, rotor housing, pins, springs and slippers are furnished as a service package. The pump body, pump cover seal rings and seal are all serviced separately.

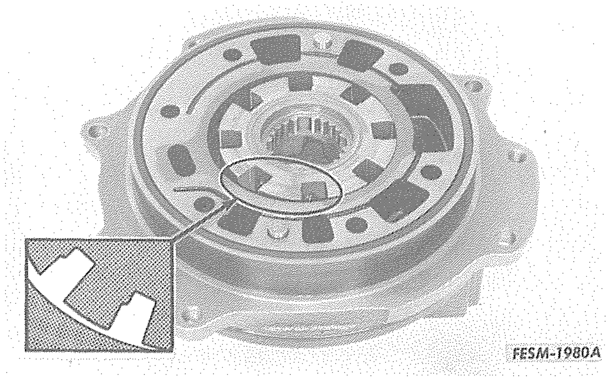
Inspect all parts for excessive wear and replace all worn or damaged parts.

Reassembly

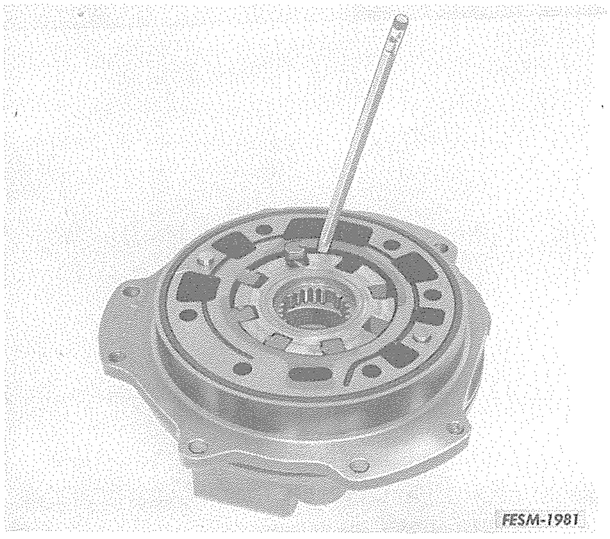

FESM-1979

Rotor housing installed.

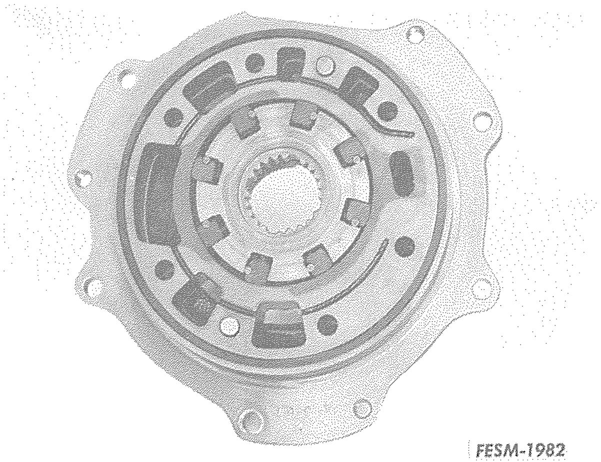
1. Place the pump body on a bench and using a new seal ring install the rotor housing as shown.


FESM-1980A

2. Place the rotor into the rotor housing, as shown. The notches for the pins are the leading edge in the direction of rotation (clockwise from the front end of the pump). It is possible to assemble it incorrectly (upside down).

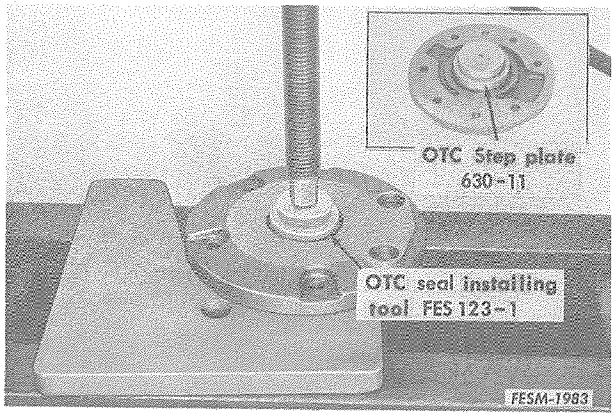

FESM-1981

3. Install the slippers with the notch for the spring toward the inside and install the springs and pins. Use a pencil or other soft object as shown to assist in installation.



FESM-1982

4. Install a new seal ring for the front cover in the rotor housing.



FESM-1983

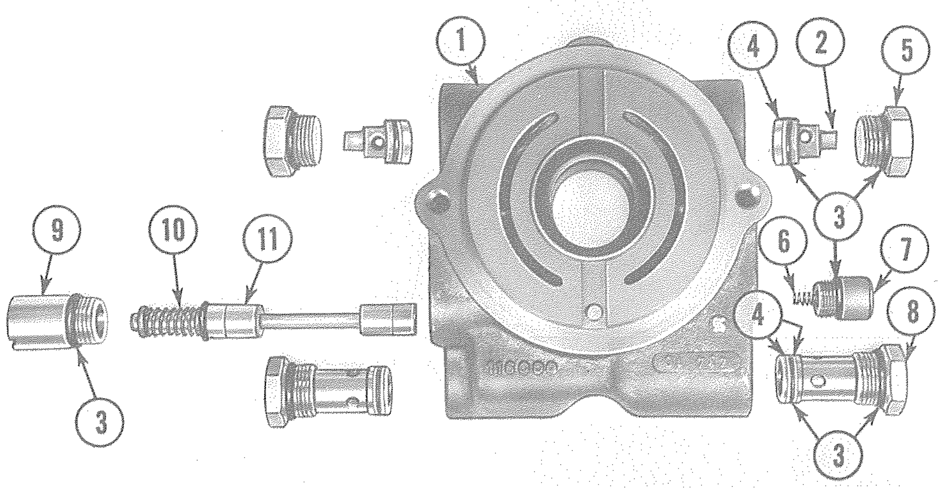
5. Install a new oil seal in the front cover, using special tool FES 123-1 and place cover on over dowels.

IMPORTANT: Oil seal must be pressed into place carefully and the FES 123-1 tool used to prevent distortion of the pump cover and to position the seal. When pressing the oil seal into place a support must be used around the center portion of the cover only (OTC step-plate 630-11) Using special tool FES 123-1, press the seal in until the bottom of the special tool contacts the step plate that is supporting the cover. The seal when properly installed will have a dimension of .513±.005 inches from the bottom of the cover to the top of the seal and will not be bottomed in the counterbore.

6. Lubricate thoroughly with Hy-Tran.

7. Install cover capscrews using the washers under the heads and torque to 35 ft. lbs.

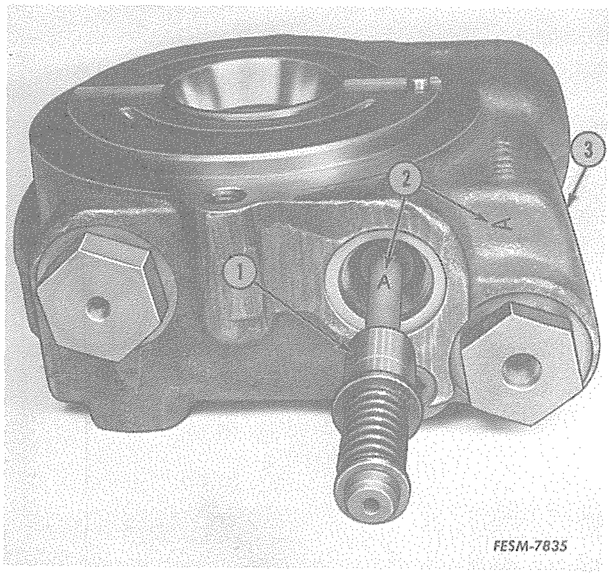
Center Section



1. Center section body
2. Check valve assembly
3. O-ring
4. Back up ring
5. Plug
6. Shuttle centering spring
7. Shuttle valve spring plug assembly
8. Relief valve
9. Shuttle valve spring retainer plug
10. Shuttle valve centering spring
11. Center section shuttle valve

In disassembling the center section be sure not to damage either side of the center section machined surface. The FES 123-9 surface protector should be used for this purpose. When removing the center section shuttle valve care should be used not to drop it and it should be wrapped carefully and put aside.

NOTE: Valves must be matched with the same identification letter as is stamped on center section body. Replacement valves must be ordered by the alphabet letter indicated in the parts catalog.

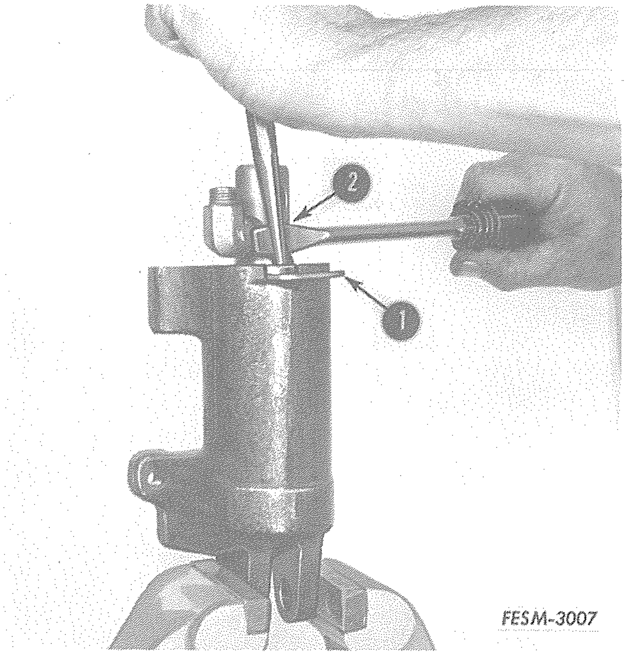


1. Shuttle valve
2. Identification marks
3. Center section body

Servo Cylinders

The following components can be removed and serviced individually by removing the cam mounting cover assembly.

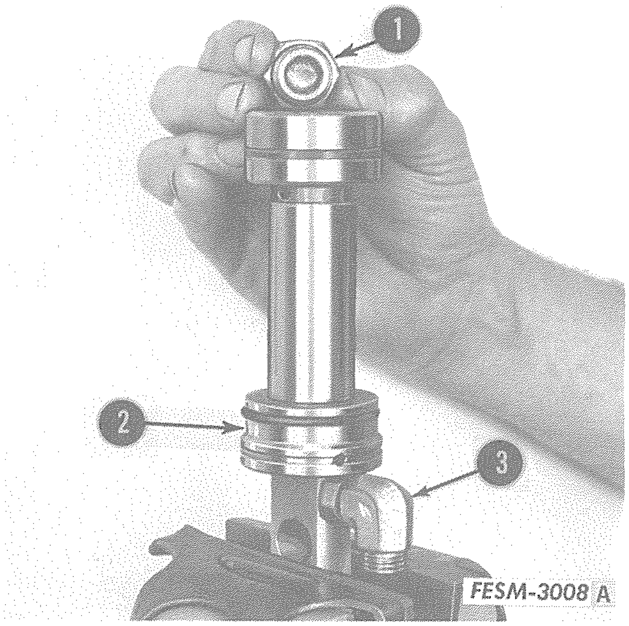
Disassembly



1. Place the servo in a vise and using a punch in the hole in the rod guide and a screwdriver, rotate the guide until the retaining ring is rolled out of the groove.

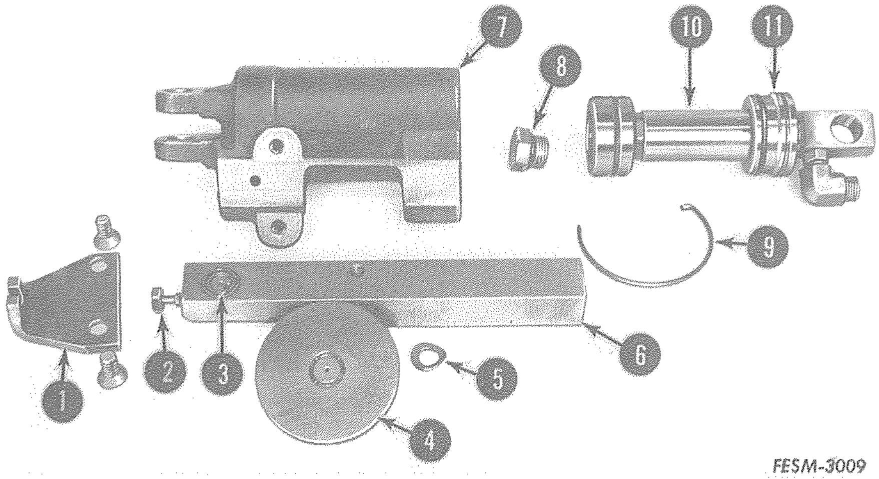
2. Remove the piston and guide together.

1. Retaining ring
2. Rotating piston guide to roll out retaining ring



3. Place the piston assembly in a vise and remove the fixed orifice plug assembly which will expose the screen for cleaning. It will be necessary to remove the elbow in the piston rod in order to remove the lower rod guide.

1. Fix orifice plug assembly
2. Piston guide
3. Elbow



FESM-3009

1. Adjusting block bracket	7. Cylinder body
2. Adjusting block bolt	8. Fix orifice plug assembly
3. O-ring	9. Retaining wire
4. Pump cylinder control orifice	10. Piston
5. Spring washer	11. Piston guide
6. Variable orifice adjusting block assembly	

4. The illustration shows the pump servo with block assembly and adjusting bracket. The teflon seals and O-rings inside the guides need not be removed unless damaged.

CAUTION: DO NOT USE A PUNCH TO TURN THE GUIDE WHILE REMOVING THE RETAINING RING AS THIS CAN DAMAGE THE GUIDE AND CAUSE BINDING ON THE SHAFT.

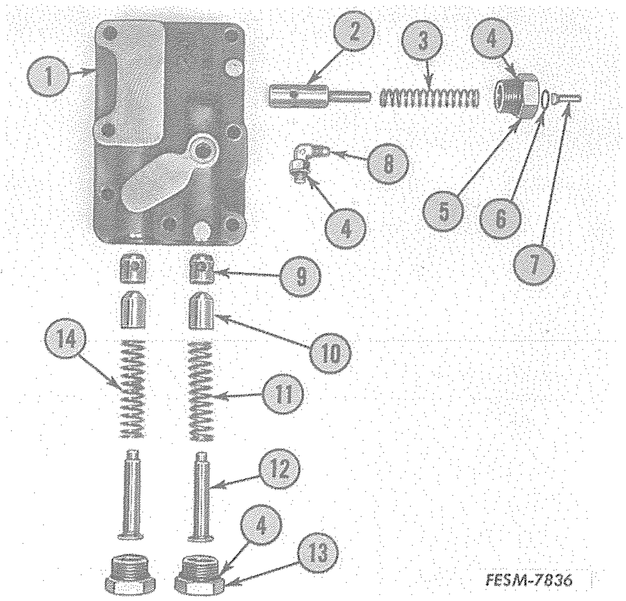
Inspection

Wash all parts in clean diesel fuel and oil liberally with Hy-Tran.

1. Check the cylinder bore for scoring.

2. Check the Teflon seals for wear and deep scratches and replace as necessary.

Multi-Valve



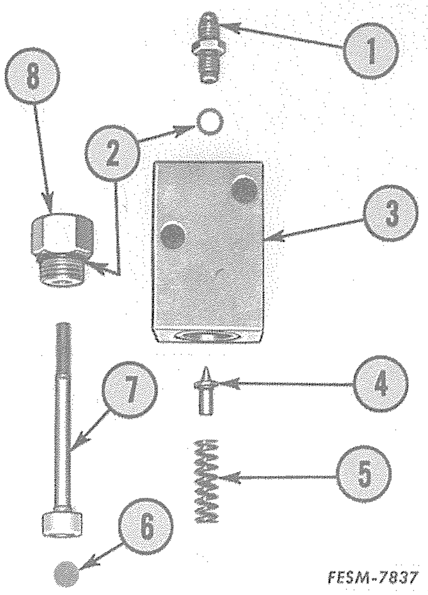
1. Body
2. Cooler by-pass valve
3. Cooler by-pass spring
4. O-ring
5. Cooler by-pass valve plug
6. Oil seal
7. Pressure check pin
8. Elbow
9. Poppet valve bushing
10. Poppet valve
11. Poppet valve heavy spring
12. Poppet valve piston pin
13. Valve retaining plug
14. Poppet valve light spring

The multiple valve is mounted on top and in front of cam mounting cover assembly of the transmission. The multi-valve contains three valves: Max. relief, Min. relief, and Oil cooler by-pass valve. The Max. relief valve is regulater at 180 to 240 psi and the Min. is regulater at 80 psi. All parts and components are serviced separately. Refer to illustration for proper placement of parts.

Foot-N-Inch and Deceleration Valve

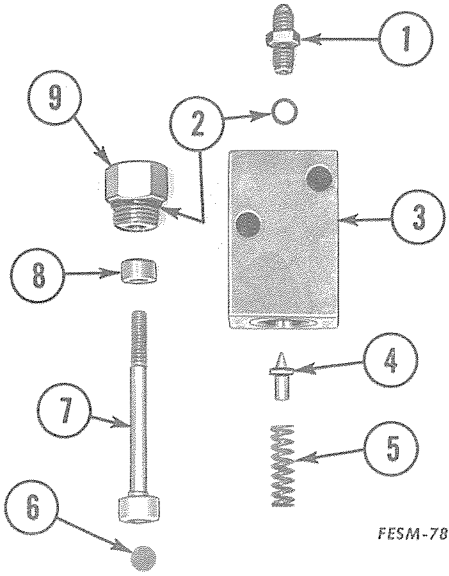
The foot control models do not use a Foot-N-Inch valve to "Feather", or a drive control valve. They use a dump valve (which is the same valve as the Foot-N-Inch valve) but is used only to dump drive pressure. The dump valve is a pilot for the pilot operated relief valves in the center section. When the valve is depressed, they open.

NOTE: Only difference between the Foot-N-Inch valve and the Decelerator is that the Foot-N-Inch valve does not have the valve stop sleeve.



FESM-7837

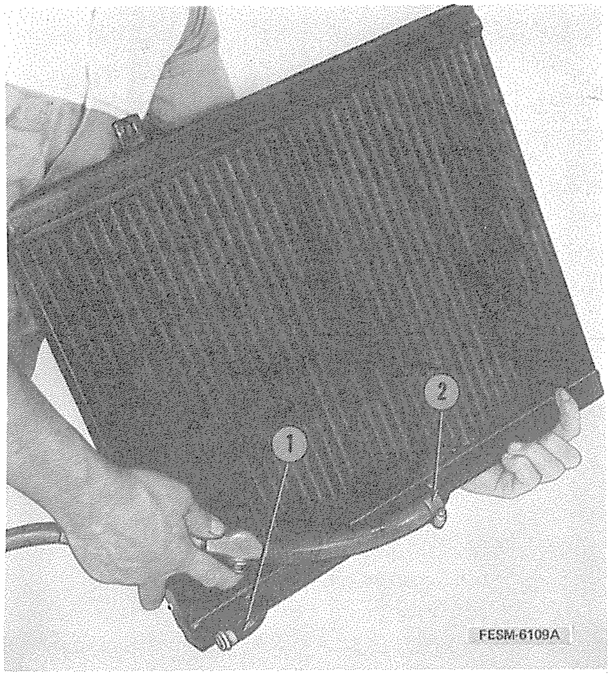
1. Poppet valve seat
2. O-ring
3. Valve body
4. Valve poppet
5. Valve spring
6. Shims
7. Valve stop
8. Valve spring stop guide



FESM-7838

1. Poppet valve seat
2. O-ring
3. Valve body
4. Valve poppet
5. Valve spring
6. Shims
7. Valve stop
8. Valve stop sleeve
9. Valve spring stop guide

Oil Cooler



Cleaning the Oil Cooler

Remove the oil cooler and back flush with solvent and "blow through" with compressed air. Shake the cooler during cleaning.

1. Cooler in
2. Cooler out

CHECKING PRESSURES AND CHARGE PUMP FLOW

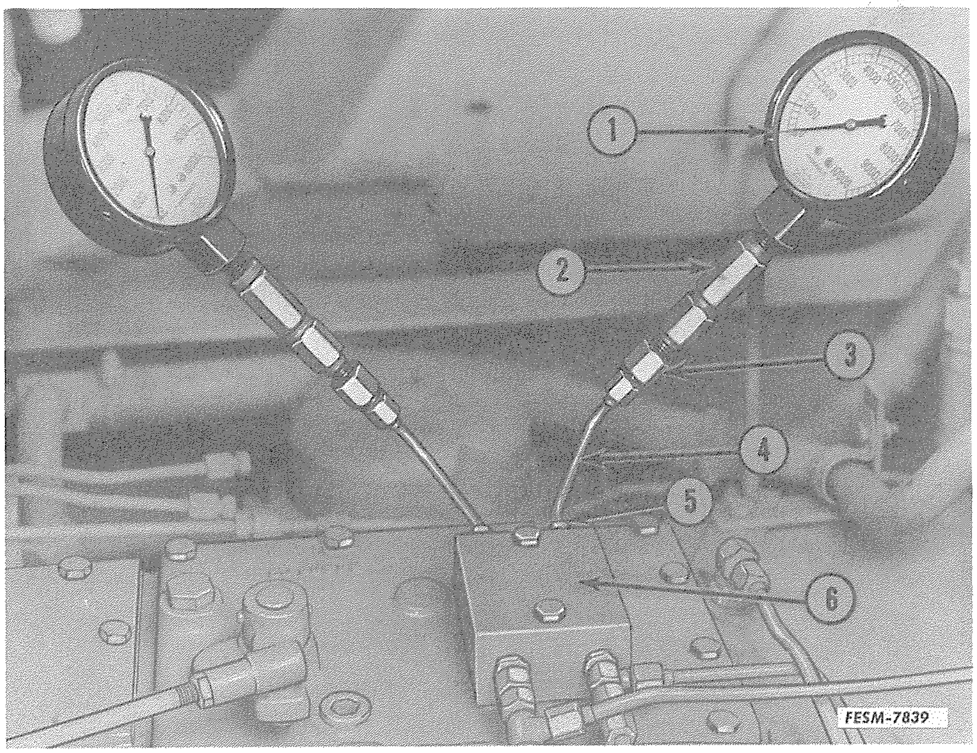
Drive Pressure

1. Warm oil up to at least 115°. Rear wheels must move so motor can rotate while checking drive pressures and charge flow.

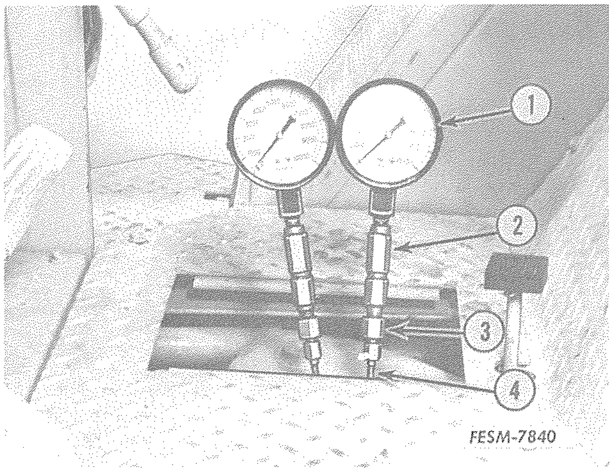
⚠ CAUTION: If checking drive pressure while in shop be sure to support tractor on jack stands and rope off area around wheels. A more accurate check can be made with tractor wheels on the ground.

2. Use only specified FES tools for pressure checks.

3. Drive pressure will depend on load applied. Brakes must hold if they are used to apply the load to build up drive pressures.



1. Two FES 96-2 0-10,000 psi gauge
2. Two FES 94-6 snubber
3. Two FES 96-3 connector
4. Two FES 123-5 steel lines
5. Two FES 123-6
6. Check valve manifold

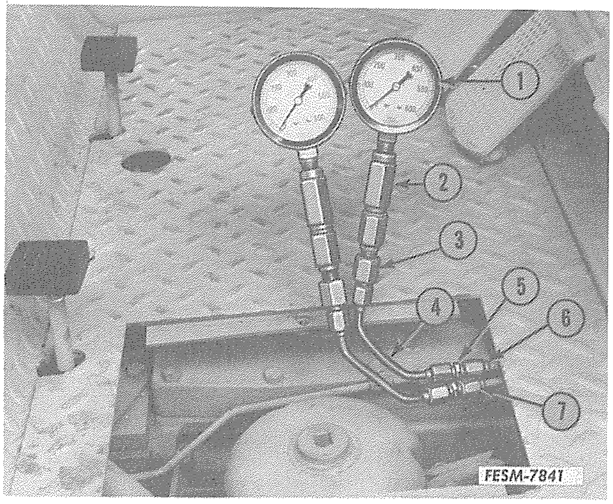


1. FES 96-2 0-10,000 psi gauge
2. FES 94-6 snubber
3. FES 96-3 connector
4. FES 123-5 steel lines

4. To check drive operating pressures on 3400 and 3500 tractors, remove filter cover and install gauges as shown in illustration. With engine at rated speed and range selector in high range apply brakes gradually (pedal travel approximately 1") pressures should read 6600 psi forward ± 100 psi and 2500 to 3100 psi reverse. On the 2400 and 2500 tractors, with the range selector in high range, drive pressure should read 5500 psi in forward and in reverse, Low range: 2500 to 3100 psi. Forward and reverse: 5500 psi.

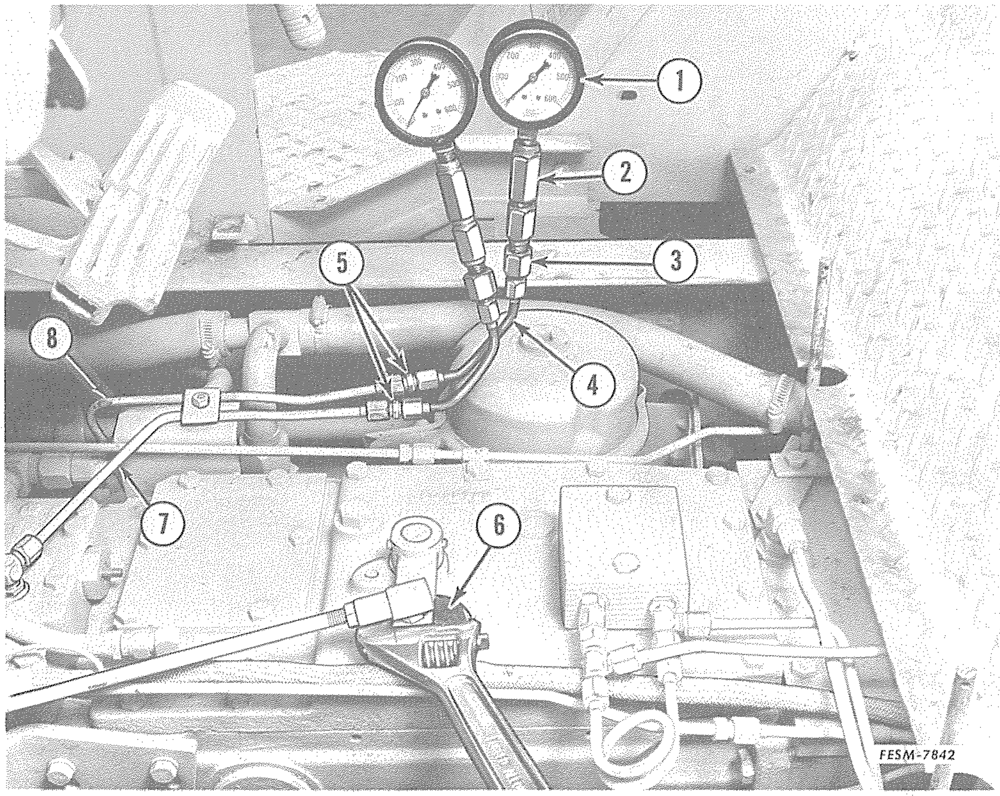
Charge and Servo Pressure

1. It is not necessary to remove floor deck assembly to check either the servo and/or charge pressure. Remove filter cover and install gauges as shown. When checking servo pressure set throttle at 900 rpm and tractor in stroke, pressures should read from 390 psi to 430 psi. In checking charge pressure throttle should be set at 900 rpm and tractor in stroke charge pressure should read 90 psi minimum to 120 psi maximum. Charge pressure in neutral should read 180 psi minimum to 240 psi maximum.



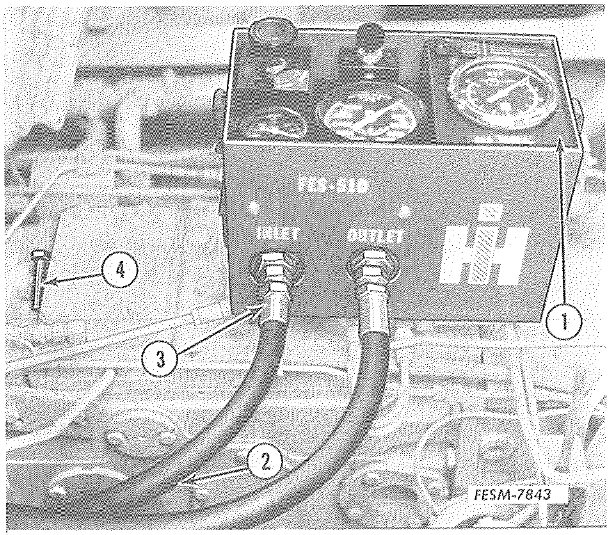
1. FES 96-1 gauges
2. FES 94-6 snubber
3. FES 96-3 connector
4. FES 123-5 steel lines
5. FES 2-81 male to male union
6. Charge pressure
7. Servo pressure

Checking servo and charge pressure with foot control linkage removed use wrench as shown.



1. FES 96-1 gauges
2. FES 94-6 snubber
3. FES 96-3 connector
4. FES 123-5 steel lines
5. FES 2-81 male to male union
6. Adjustable wrench
7. Charge pressure
8. Servo pressure

Measuring Charge Flow



A Flo-Rater is essential in measuring charge flow. Using FES 51D Flo-Rater connected in series with oil cooler return line. The inlet side of the Flo-Rater is connected to the return line coming from oil cooler using FES 2-48 hose assembly with FES 2-35 tube union. The outlet side is connected into the left hand side relief valve access cover.

IMPORTANT: The restriction valve on the Flo-Rater has to be fully opened at all times to eliminate build up of pressure.

1. FES 51-D Flo-Rater
2. FES 2-35 tube union (at end of hose)
3. FES 2-48 hose assembly
4. Bolt to block out oil cooler by-pass

Charge Pump Flow in Neutral	
Engine RPM	Gallons Per Min.
2400	10.8
2000	9.0
1500	6.6
1200	4.8
900	3.6

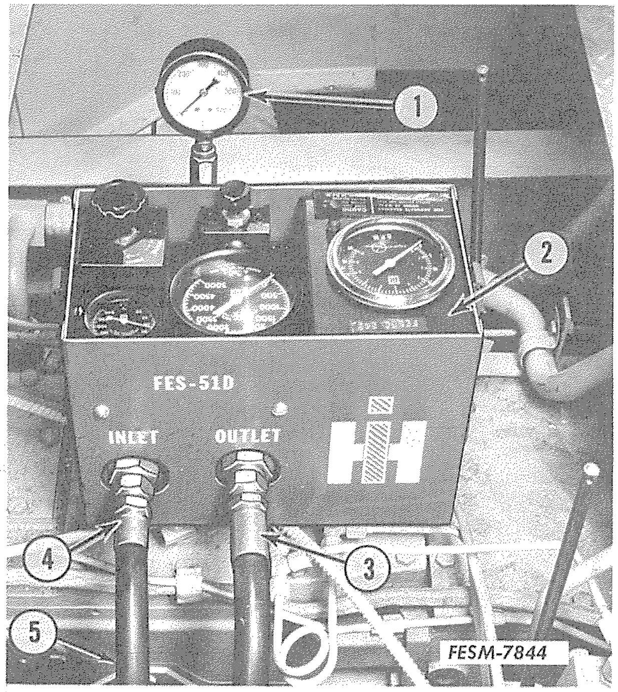
NOTE: If flows are lower than indicated, push pin in on oil cooler by-pass valve and block, this will prevent the oil cooler by-pass valve from opening because of a restricted oil cooler.

Charge Pump Flow
(Used in Trouble Shooting)

Charge Pump Flow in Neutral	
Engine RPM	Gallons Per Min.
2400	10.8
2000	9.0
1500	6.6
1200	4.8
900	3.6

If drive pressure is below specifications in either forward or reverse or efficiency seems low check as follows.

Charge flow will be relatively the same for forward and reverse with no load on the transmission. You can expect a slight loss of GPM when drive pressure is applied below the flow specified when in neutral.

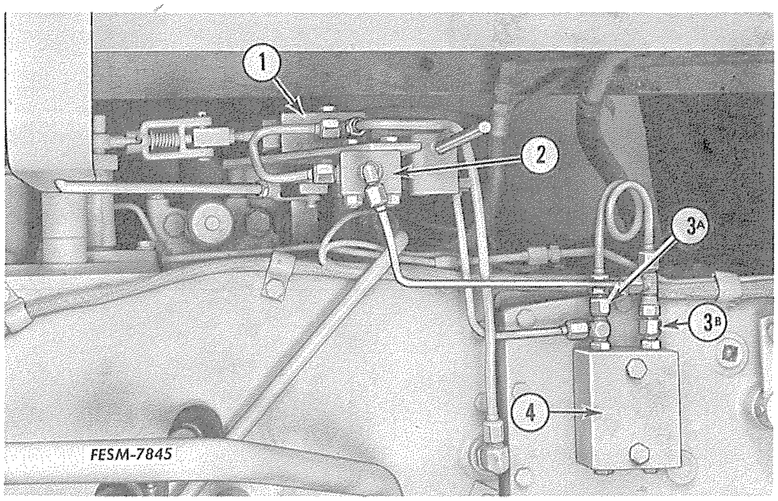


1. FES 96-1 charge psi
2. FES 51-D Flo-Rater
3. FES 2-48 connected to L.H. relief valve access cover
4. FES 2-48 Connect to line coming from oil cooler
5. FES 2-35 tube union (at end of hose)

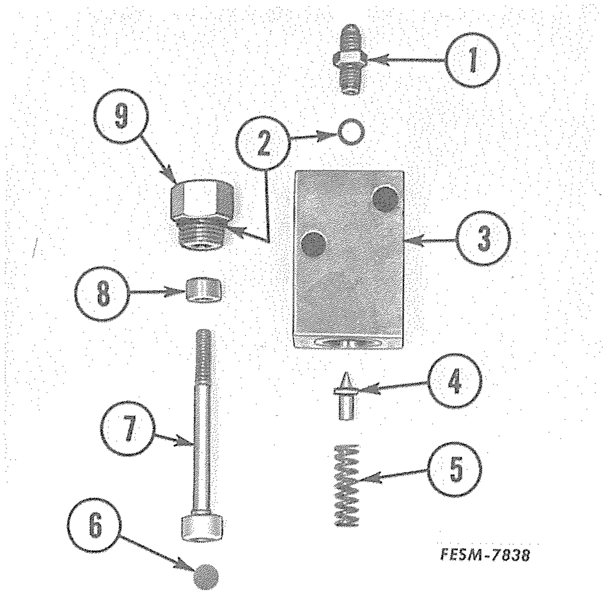
Remove floor deck assembly and place Flo-Rater as shown. Motor must rotate (wheels moving) for accurate readings. Operate in high range with the cam actuating lever moved in direction of travel and apply brakes slowly pulling the engine rpm down to speeds indicated in neutral and record them. Keep drive pressure just below relief valve pressure when checking flow. The brakes must hold in order to be able to build maximum drive pressure but the tractor must be moving.

ADJUSTMENTS

Two Position Deceleration Valve



1. Decelertion valve
2. Foot-N-Inch valve
3. Check valve
4. Pilot relief manifold

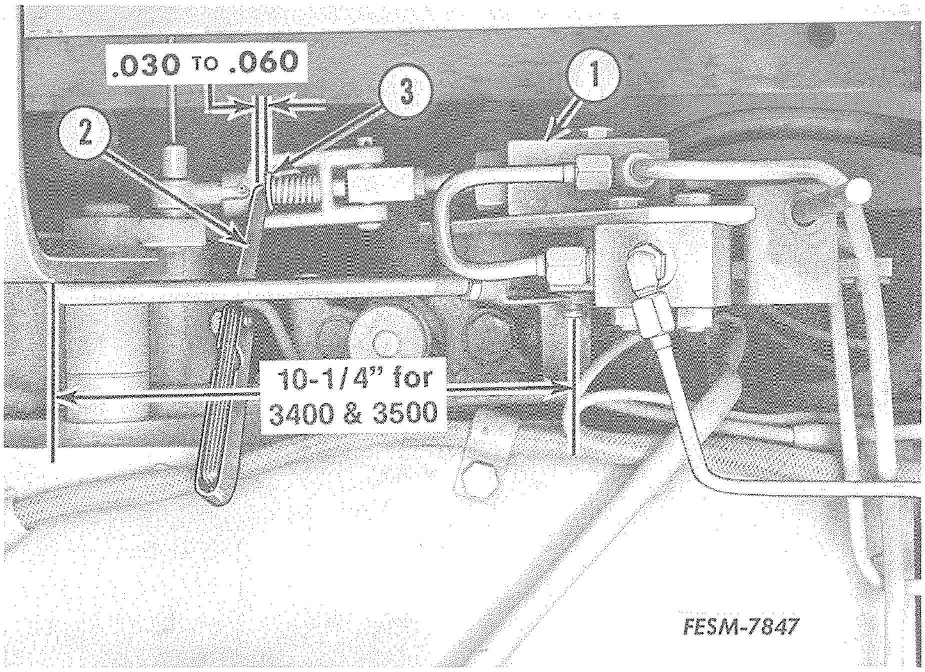


1. Poppet valve seat
2. O-ring
3. Valve body
4. Valve poppet
5. Valve spring
6. Shim
7. Valve stop
8. Valve stop sleeve
9. Valve spring stop guide

The Foot Control Models have a two position Deceleration valve. The valve is attached to the range transmission shift linkage, and is for the purpose of effecting a cushioned Deceleration when operating in high range. The two position Deceleration valve is a pilot for the reverse high pressure relief valve in the center section and has two settings. The Foot-N-Inch valve is a pilot for the forward high pressure relief valve.

When the range transmission is shifted to high range, the Deceleration valve is repositioned by the range transmission linkage and the Deceleration pressure and reverse drive pressure is then limited to 2500 to 3100 psi on all models. When the tractor is in forward drive, pressure to the Foot-N-Inch valve goes through a one way check valve "3B". A one way check valve "3A" prevents forward drive pressure from going to the Deceleration valve or into the reverse drive line. When Deceleration is in reverse the Deceleration valve is also blocked off. When drive pressure is developed in the reverse drive line while driving in reverse or Deceleration in forward, this pressure goes through check valve "3A" to the dump valve and is prevented from entering the forward drive line by check valve "3B". When driving in reverse high range, the drive pressure will be limited to 2500 to 3100 psi by the two position Deceleration valve. Before adjustment of either the Deceleration or Foot-N-Inch valve is done, remove floor deck assembly seat and seat deck assembly on 3400 and 3500. First adjust range transmission by putting the range shift lever assembly in low range and check reference dimension 10-1/4 (see illustration) from center to center on the connecting rod. On 2400 and 2500A series tractor, with range lever in high, loosen jam nut on range rod and adjust clevis so lever assembly is 13/16" from bottom of pocket of transmission shift housing assembly.

To adjust the Deceleration valve, make sure range shift lever is in low range. Using feeler gauge as shown in illustration a clearance of .030" to .060" must be maintained between washer and clevis end.



Foot-N-Inch Valve

Remove floor and seat deck assembly. Disconnect necessary hydraulic lines and remove the Foot-N-Inch and Deceleration valve mounting bracket assembly and place it in a vice as shown in the illustration.

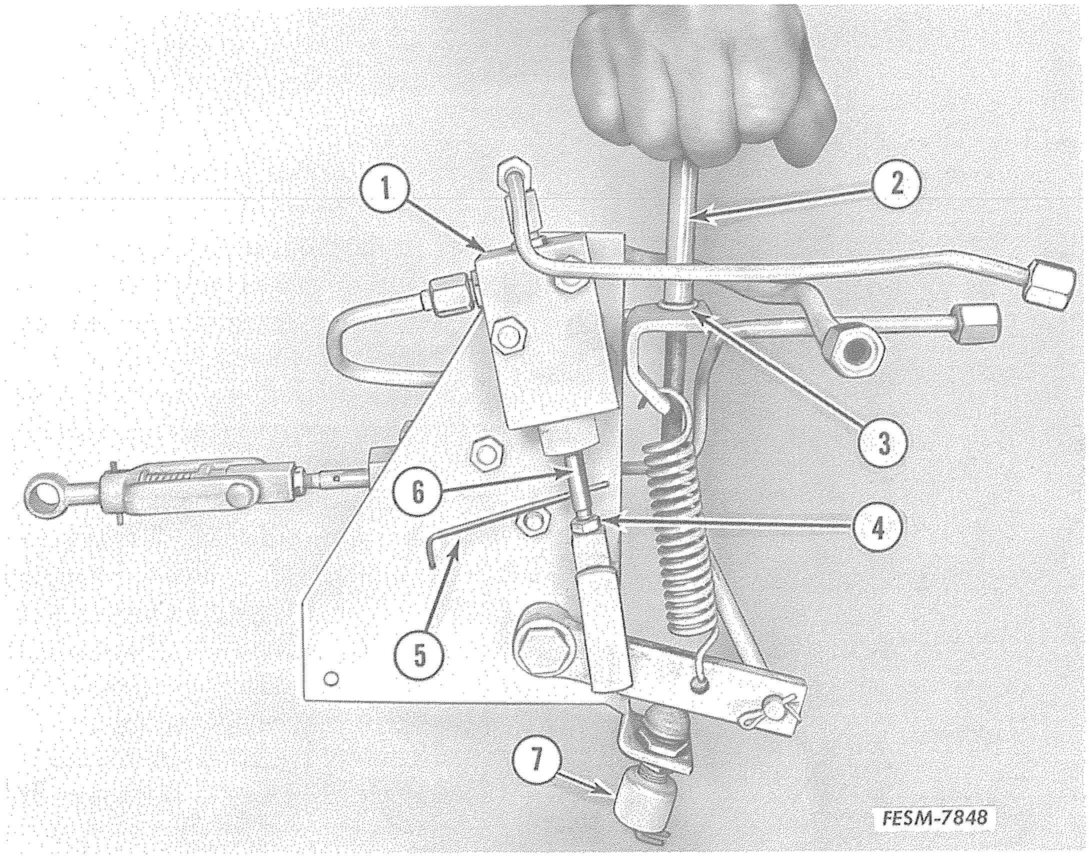
1. Depress pedal against stop.

2. Loosen jam nut and rotate the Foot-N-Inch valve stem until fully extended into adjusting block.

3. Back off valve stop one complete turn and lock jam nut.

CHECKING FOOT-N-INCH AND DECELERATION VALVE

With everything hooked up normally, disconnect the drain line coming out of the sides of the valves. If fluid comes out of either of the valves below relief valve pressure, the seat and poppet are leaking or the spring is weak.

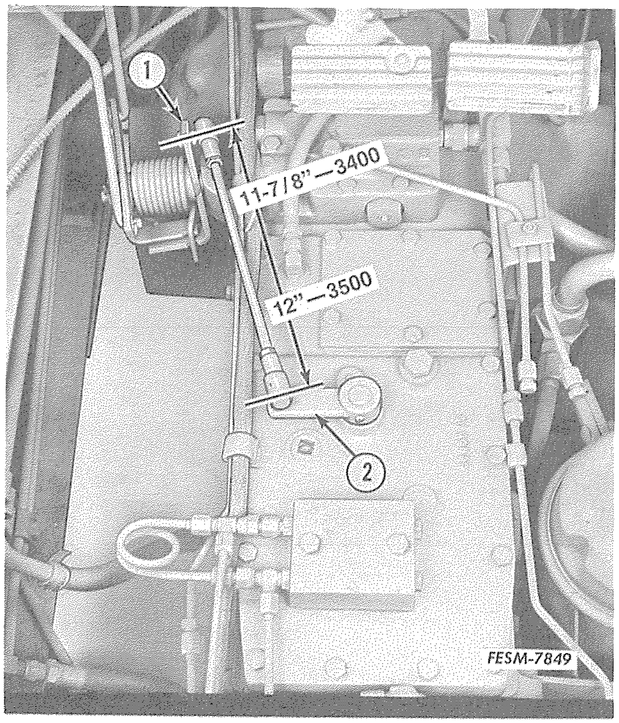


1. Foot-N-Inch valve
2. Dump pedal assembly
3. Stop
4. Jam nut
5. Allen head wrench
6. Valve stop
7. Safety starting switch

SAFETY STARTING SWITCH ADJUSTMENT

Illustration shows 3400 and 3500 series. After adjustment of the Foot-N-Inch valve, depress pedal against stop and adjust switch so plunger is depressed approximately 1/8" ± 1/16".

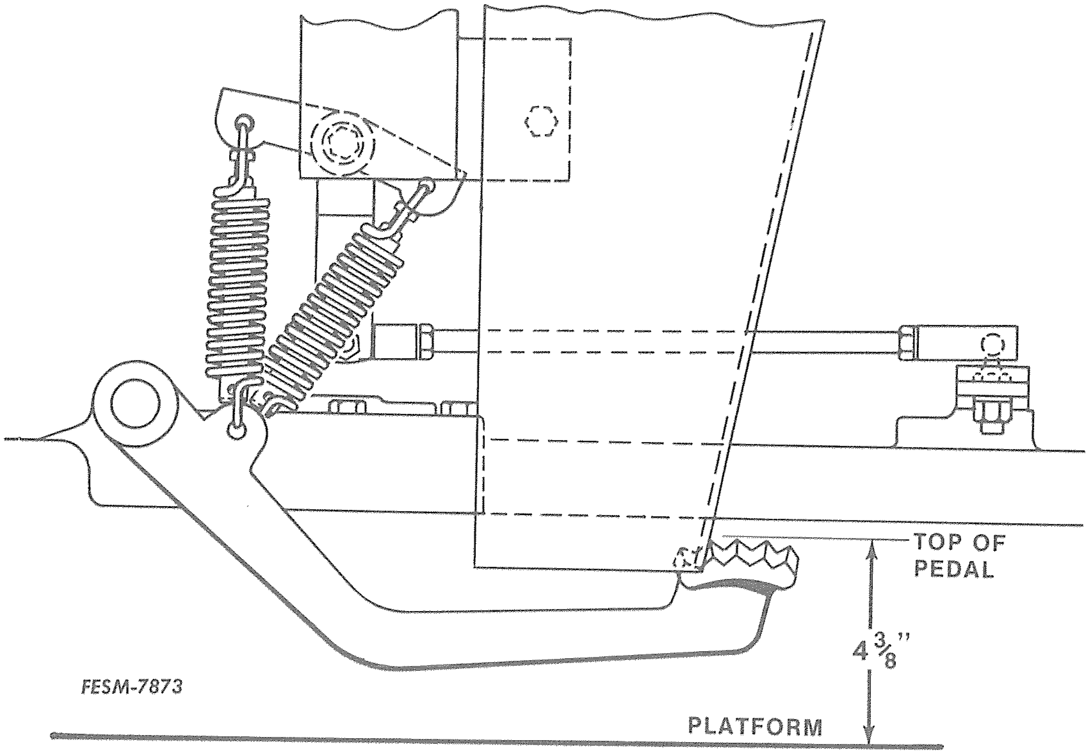
CAM ACTUATING ROD ADJUSTMENT



1. Pivot cam assembly
2. Cam actuating arm

Remove floor deck assembly and front floor. Measure from center of the cam actuating assembly to the center of pivot cam assembly. The dimension should be 11-7/8" on the 3400 and 12" on the 3500. Note illustration.

On 2400 and 2500A series tractors, remove housing covers and with cam control lever in neutral, adjust speed control cam rod so the forward and reverse speed control bellcrank assembly is vertical. A reference rod length to obtain this is 11-3/8" from center to center. Adjust forward speed control pedal assembly to 4-3/8" from platform to the top of pedal tread. This setting is established by loosening jam nut on 1/4" hex head capscrew and adjusting hex head capscrew to the 4-3/8" dimension and lock jam nut. Note hole in bottom of rod allows the use of pin punch or Allen wrench to hold rod while turning capscrew. Adjust reverse speed control pedal assembly as covered above so it aligns with the forward pedal.



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NEUTRAL RESPONSE ADJUSTMENT

REMOVE FLOOR DECK ASSEMBLY

Neutral adjustment to cam actuating arm is established when the pump servo variable orifice is positioned (lengthwise) so that it is on the same radius as the neutral zone on the control cam.

CHECKING FOR NEUTRAL

1. Raise tractor off ground and support on jack stands so wheels will be free to rotate.

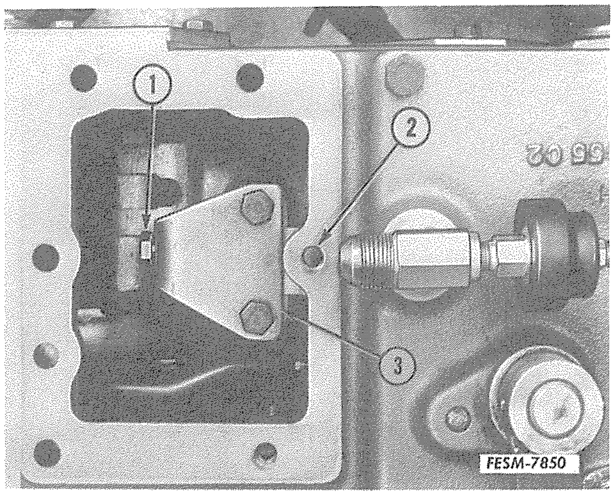
2. If charge pressure reads 180 to 240 psi in neutral, the unit is set properly. If a reading between 80 to 120 psi is obtained, the neutral setting is not in adjustment and the following procedure must be followed:

a. With range transmission in low range at idle engine speed, observe the rotation of wheels. If wheel creeps forward, loosen adjusting bolt.

b. The adjustment required must be made to obtain 180 to 240 psi.

IMPORTANT: Do not operate engine with the capscrew on the adjusting block bracket loose as the "O"-ring under the adjusting block may be blown out.

c. When replacing hex head capscrew to retain cover to housing, be sure to put the short capscrew on the back center hole.



1. Adjusting block bolt
2. Location of short capscrew and copper washer
3. Adjusting block bracket

TRUNNION SHIM PACK ADJUSTMENT – PRIOR TO REASSEMBLY OF PUMP AND MOTOR

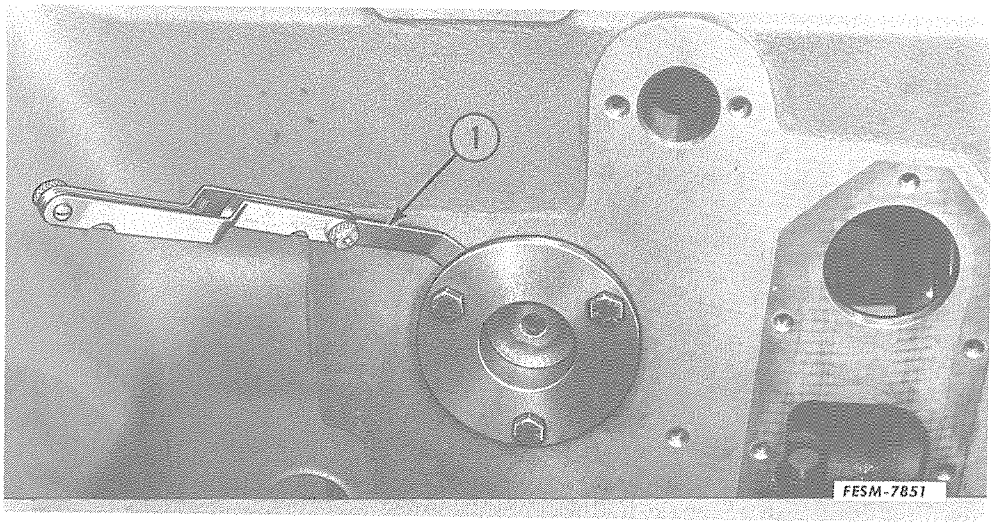
1. Insert the pump swash plate and install the swash plate trunnions with lubricant on bearings less the O-ring and shims.

2. Install capscrews on both left and right hand trunnions.

3. Fully torque the capscrews on the right hand trunnions to 35 ft. lbs.

4. Torque the three capscrews on the left side trunnion to 20 in. lbs. while oscillating the swash plate back and forth.

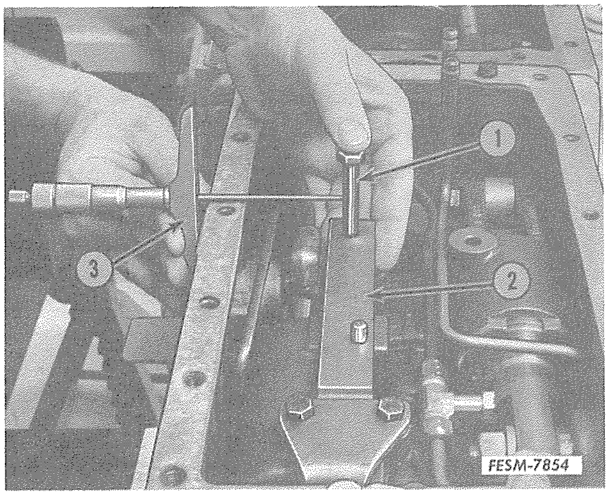
5. Without oscillating the swash plate torque the capscrews to 35 in. lbs.



1. Feeler gauge

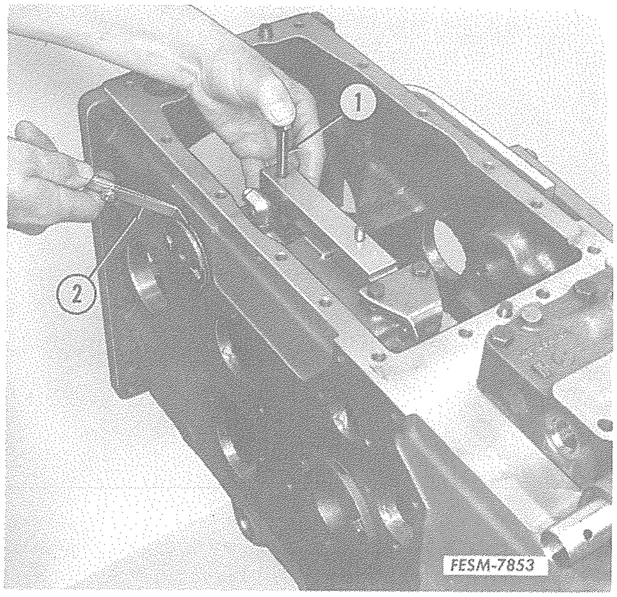
6. Measure the shim gap between the flange on the left hand swash plate trunnion and the housing near the 3 capscrews. The correct shim pack is equal to the average measured gap plus or minus .002 inch.

Install one-half the measured shim pack under each trunnion and torque bolts to 35 ft. lbs.



1. 3/8 bolt
2. Adjusting block
3. Depth micrometer

7. Install the pump servo cylinder and torque the servo shoulder bolt on the swash plate end from 40 to 45 ft. lbs. Install the servo trunnion with capscrews without O-rings or shims. Place the wavy washer against the cylinder rod using petroleum jelly to make certain that it does not slip down on the small portion of the trunnion. Put on the heavy washer and tighten the nut sufficiently to eliminate all end clearance between the parts.



1. Pin
2. Feeler gauge

8. Place the 3/8" pin into hole for the variable orifice and using a depth micrometer set at 3.243 from the edge of the pin to the machine surface for the servo trunnion. Retain the 3.243 dimension established and measure the correct shim pack required.

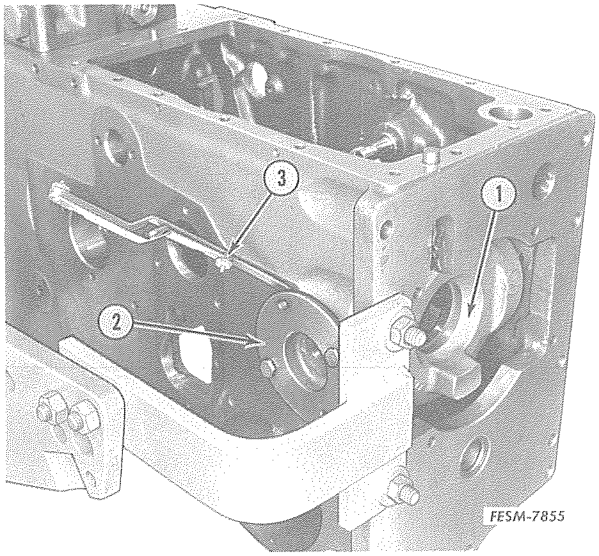
9. Install the half shims and torque the bolts to 35 ft. lbs. and tighten the nut on the anchor trunnion from 40 to 45 ft. lbs. Install the servo shoulder bolt and torque to 40-45 ft. lbs.

IMPORTANT: Establishing the correct shim gap, positions the variable orifice for the pump so that it will be in proper position for the neutral zone on the control cam. Recheck the 3.243 dimension by installing a dowel pin and push pin side ways in both directions and measure the side play and take an average reading ± .002.

10. Remove the pump servo cylinder trunnion, swash plate trunnions and swash plate and place shim pack over trunnions and set them aside for later assembly.

NOTE: Mark both right and left trunnions respectively.

Motor Swash Plate Trunnion Bearings



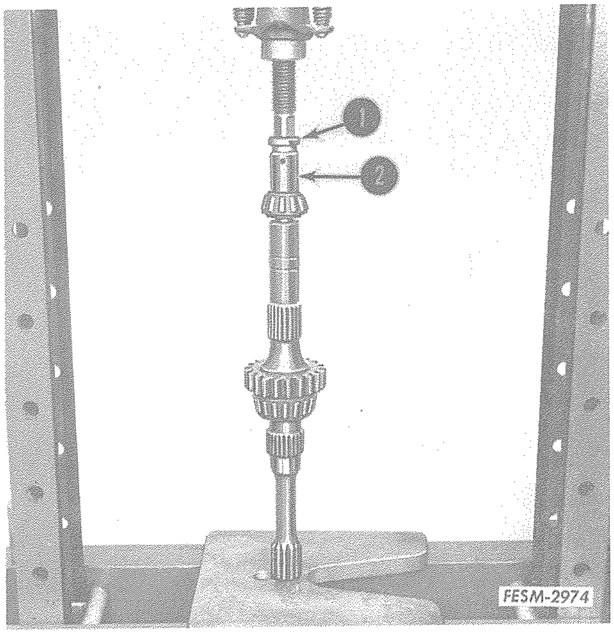
1. Motor swash plate
2. Motor trunnion
3. Feeler gauge

1. Install motor swash plate with trunnions and tighten the capscrews to 35 ft. lbs. on one side. On the opposite trunnion, install two capscrews without the Nylock inserts.

2. Torque them to 25 in. lbs. while oscillating the swash plate and 50 in. lbs. without oscillating.

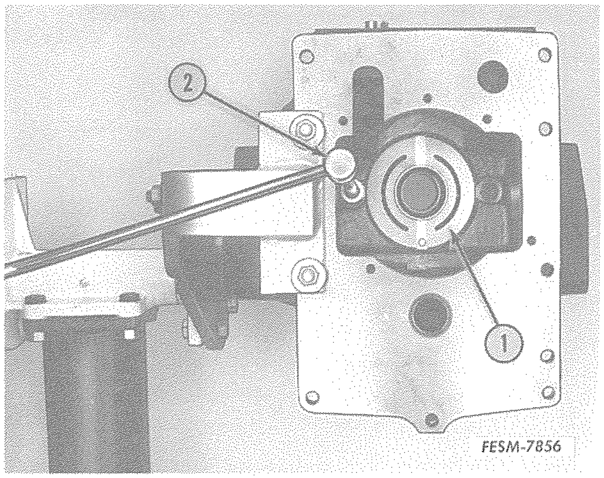
3. The average measured gap is the correct shim pack ± .002 inch. Divide the shim pack equally and place the shims on the trunnions and set them aside for final reassembly.

Pump Shaft Bearings



1. Press the rear bearing cone onto the shaft making certain that it seats on the shoulder. Use a 3/4" socket and step plate to press the cone into place.

1. Step plate
2. 3/4" socket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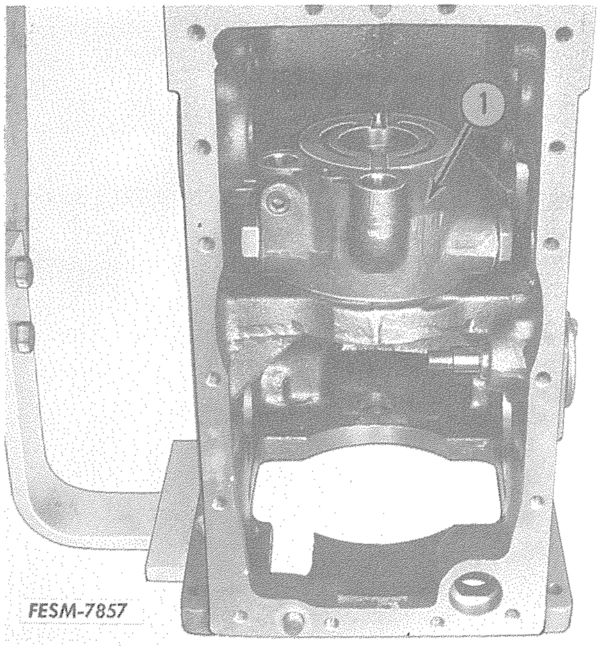
FESM-7856

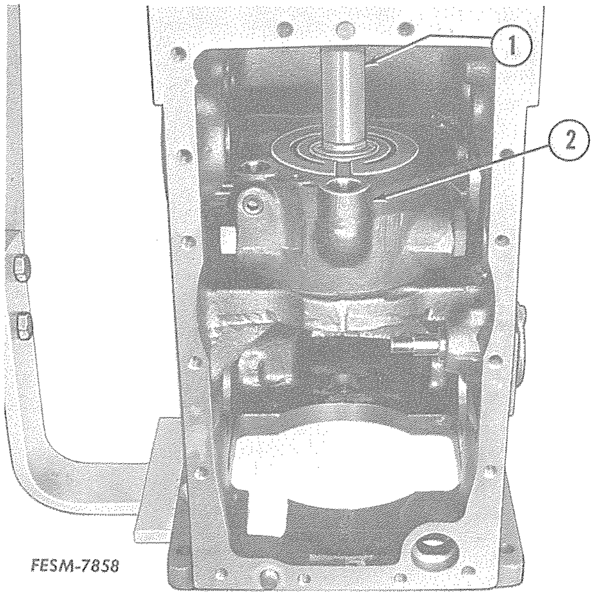
2. Install the center section with bearing cups seated and torque to 110 ft. lbs.

1. Center section
2. Torque wrench



3. Rotate the transmission housing until the bell end is up.

1. Center section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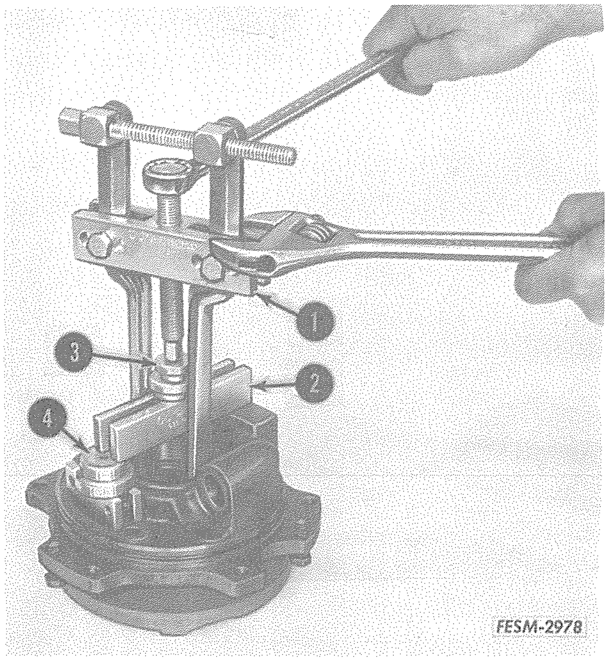
4. Install pump shaft.

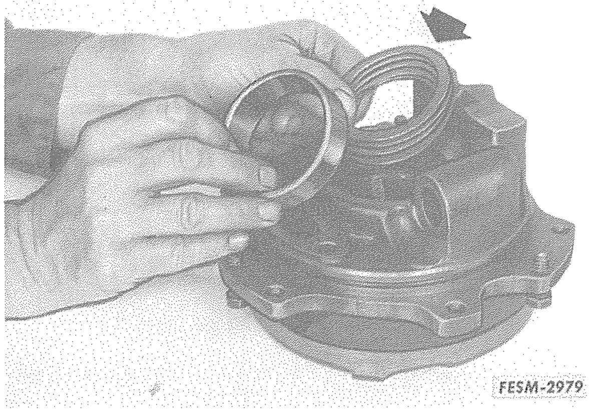
1. Pump shaft
2. Center section



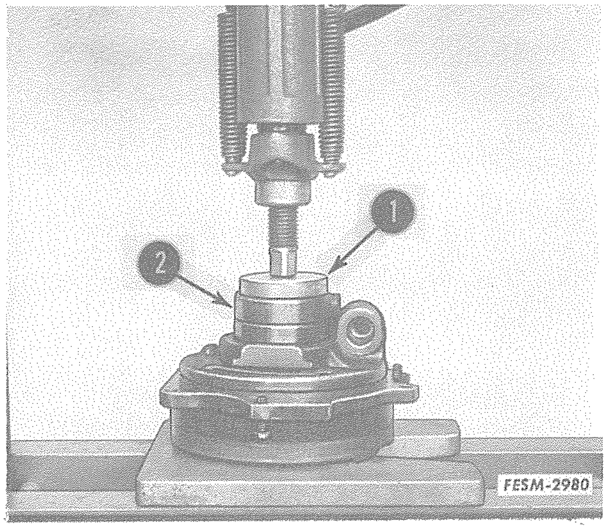
5. Remove the bearing cup using a puller.

IMPORTANT: DO NOT USE A PUNCH TO REMOVE THIS CUP AS IT WILL BE DAMAGED. SUPPORT THE CROSS BAR WITH A SPACER TO BRING IT LEVEL WITH THE SWASH PLATE STOP.

1. OTC 943E puller
2. OTC 515A cross bar
3. Step plates for spacers
4. Spacers to level cross bar

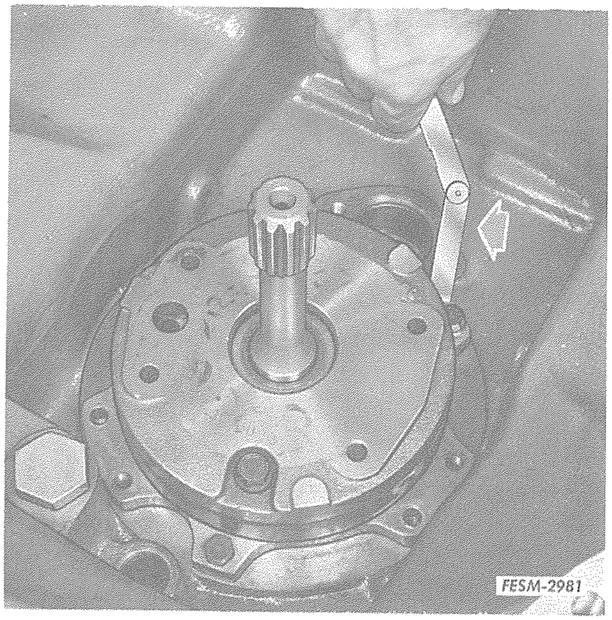


6. Place .100 thickness of shims under the front bearing cup in the bearing bore of the charge pump. This is a special fit bearing cup and must not be substituted.



7. Press the bearing cup into place using an old bearing cup and a step plate.

1. Step plate
2. Used bearing cup



FESM-2981

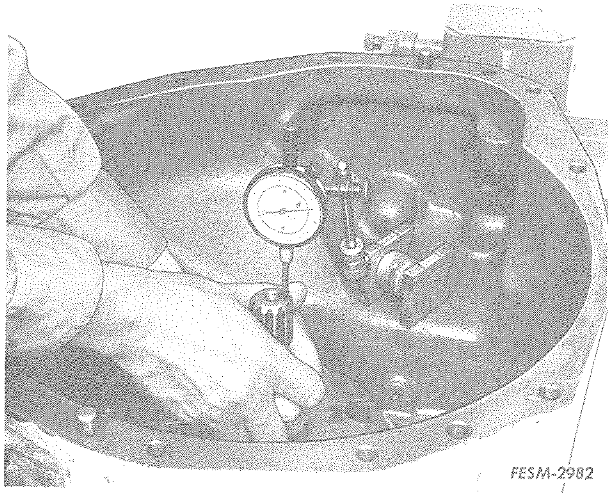
8. Place the charge pump over the input shaft and install 3 equally spaced capscrews.

IMPORTANT: DO NOT USE THE SPECIAL CAPSCREWS USED TO SECURE THE CHARGE PUMP AS THEY HAVE A NYLOCK INSERT TO PREVENT LEAKING AND THIS WILL RESULT IN AN INACCURATE TORQUE READING.

9. Tighten the 3 capscrews evenly to 25 in. lbs. while rotating the shaft, and to 50 in. lbs. without rotating. Carefully measure the gap adjacent to each bolt. The average gap measured should be added to .020 inch and subtracted from the .100. This will give the correct shim pack to be used. Example: Gap measured .041" plus .020" equals .061". Subtract from .100" for a shim pack of .039".

10. Remove the charge pump and pull the bearing cup as shown in illustration on top of page 45.

11. Install the calculated shim pack and press the bearing cup into place.



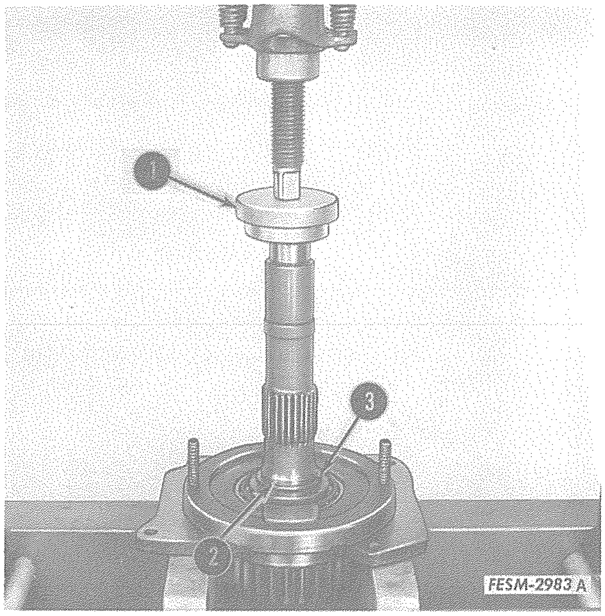
FESM-2982

12. Reinstall the charge pump and torque the 5 bolts to 35 ft. lbs. and check pump shaft end clearance with a dial indicator. The correct end play should be .001 to .011 inch.

13. Remove the charge pump and pump shaft and set them aside.

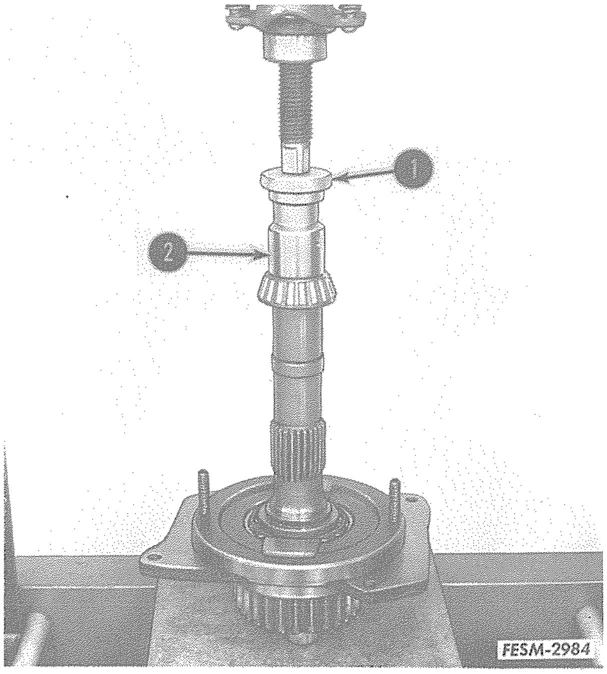
NOTE: It will be necessary to pull the rear bearing in order to reassemble the pump assembly.

Motor Shaft Bearings



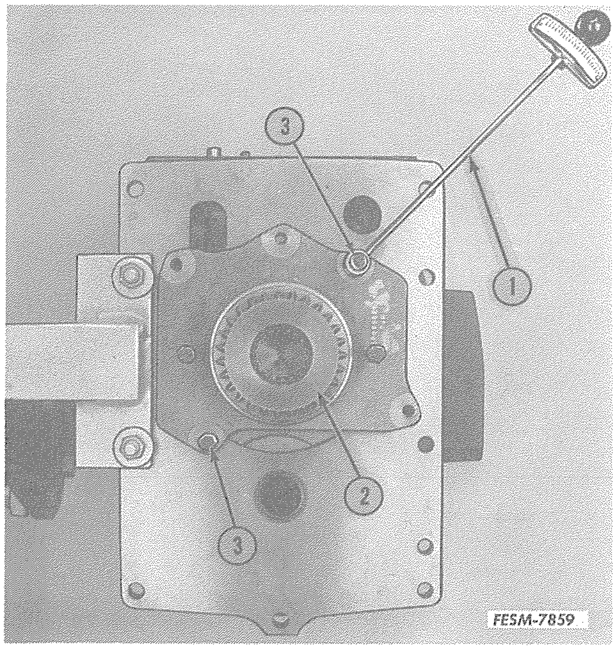
1. Step plate
2. Shaft shoulder tight against snap ring
3. FES 123-10 master bearing ring

1. Install the rear motor shaft bearing into the housing. Place a master bearing ring .215" thick in place. Install the shaft and press the shaft into the snap ring to where the bearing race is tight against it and there is no clearance between the front of the shoulder on the shaft and snap ring.



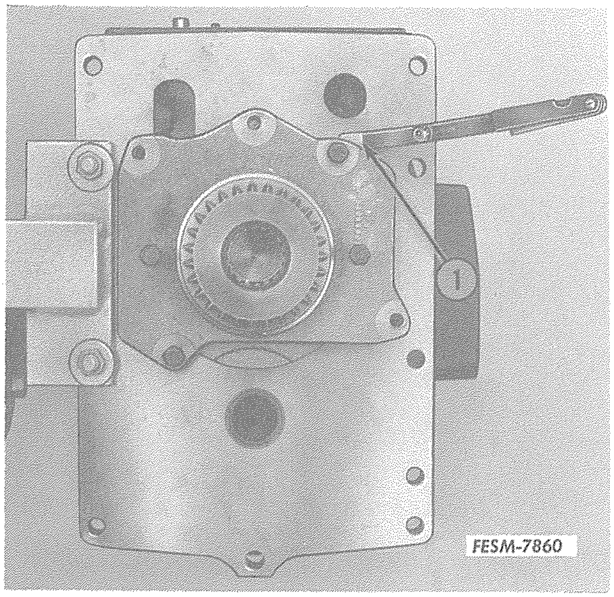
2. Press the front motor shaft bearing onto the shaft tightly against the shoulder using a 1-1/8 inch socket and step plate.

1. Step plate
2. 1-1/8" socket



3. Install the shaft assembly and torque the upper right and lower left-hand bolts evenly to 25 inch lbs. while rotating the shaft and 50 inch lbs. without rotating.

1. Torque wrench
2. Shaft assembly
3. Capscrews

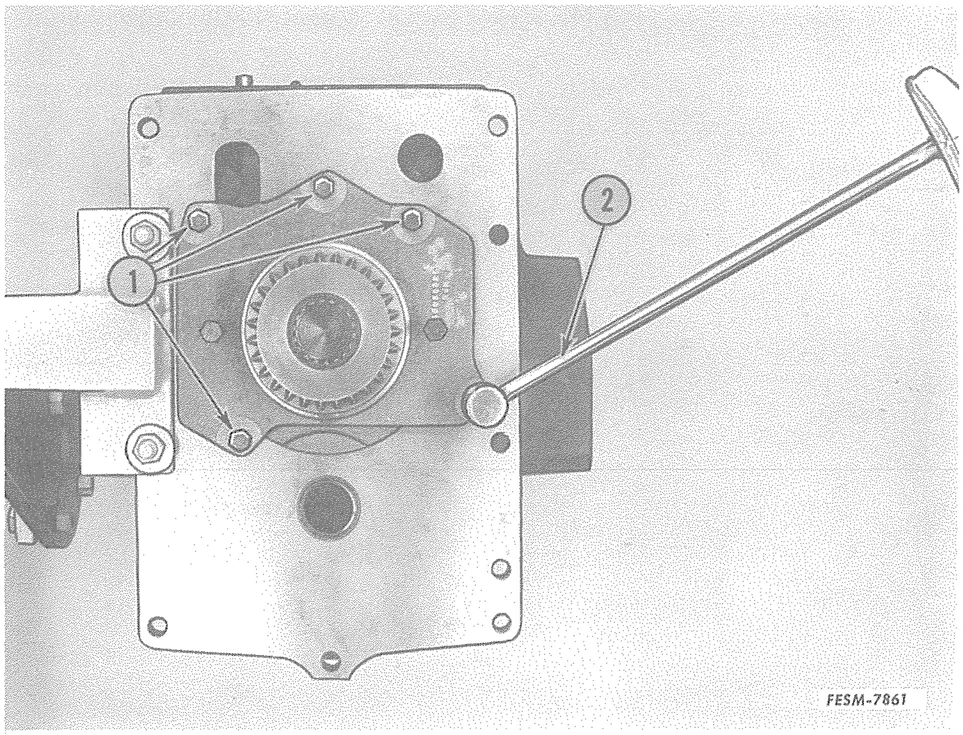


4. Carefully measure the gap between the bearing housing and the transmission adjacent to each bolt and take the average.

1. Feeler gauge

5. Subtract the average gap from .200" which will give the correct snap ring thickness ± .002". Remove the shaft assembly and install the snap ring of the correct thickness.

EXAMPLE: Average measured gap .035". Subtract .035" from .200" which will give .165" as the correct snap ring. Snap rings are furnished in thickness of .136" to .186" in increments of .005".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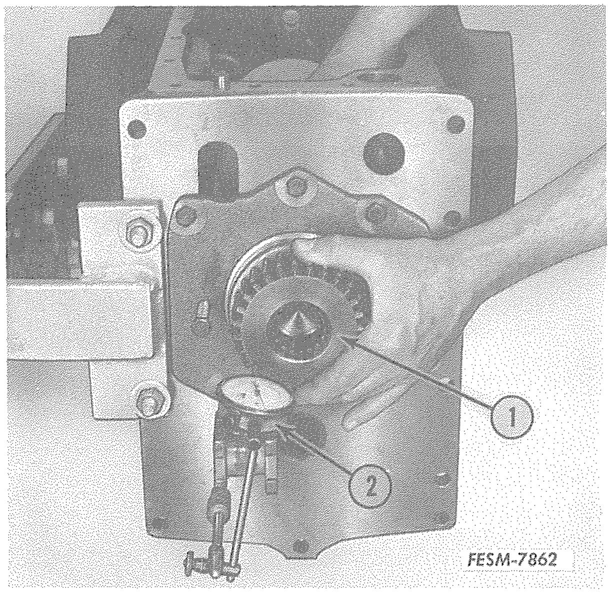
1. Capscrews
2. Torque wrench

6. Torque the five capscrews to 35 ft. lbs.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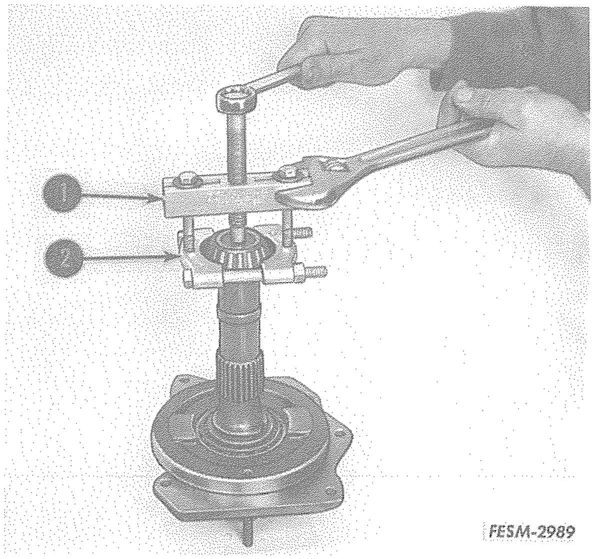
7. Measure the end play with a dial indicator. The correct end play should be .002 inches to .008 inches.

1. Shaft assembly
2. Dial indicator

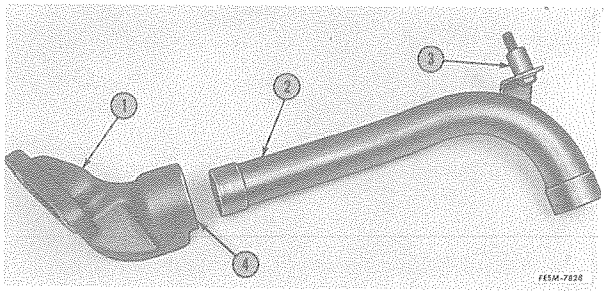


8. Remove the output shaft and pull the front bearing and set the assembly aside being careful to retain the proper calculated snap ring.

1. OTC 515A cross bar
2. OTC 950 puller plate

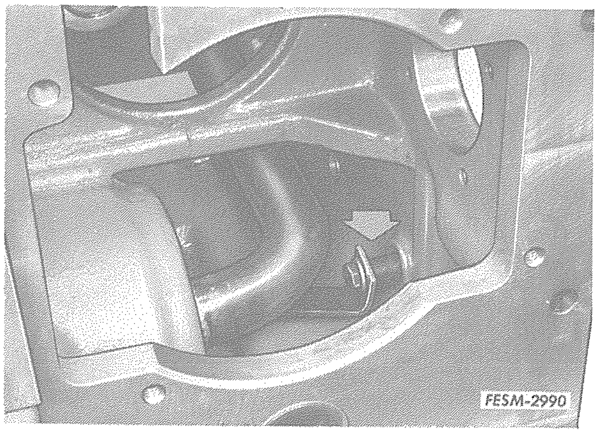
COMPONENT REASSEMBLY

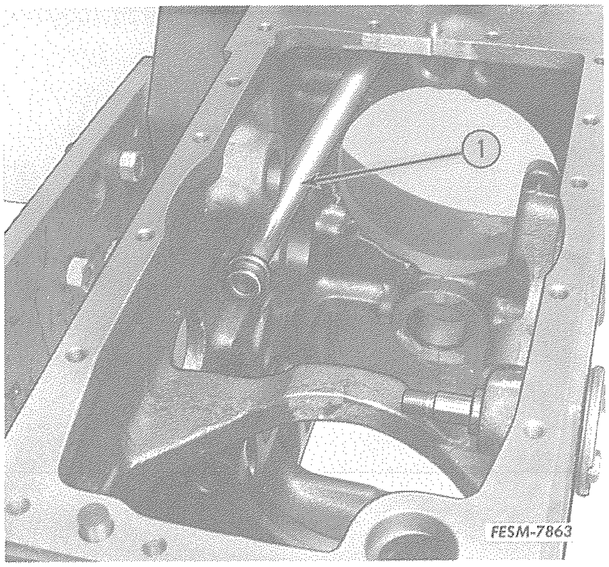
Suction and Return Tubes



1. Suction pipe elbow
2. Suction tube assembly
3. Suction pipe support spacer
4. O-ring

1. Install the suction tube and place the cast manifold on the front of it using new O-rings on both ends. Leave the suction tube bolt loose at this time to aid in later lining up the charge pump and suction tube manifold.

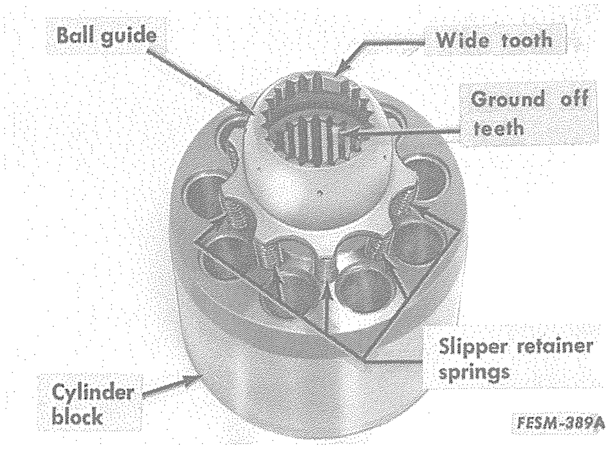




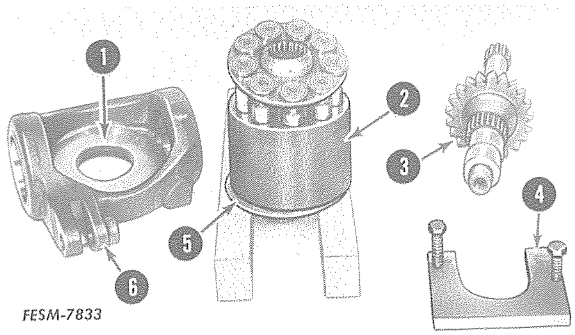
2. Install the charge pump return tube with the large flange to the rear and twist it up against the side of the case.

1. Charge pump return tube

Hydrostatic Pump

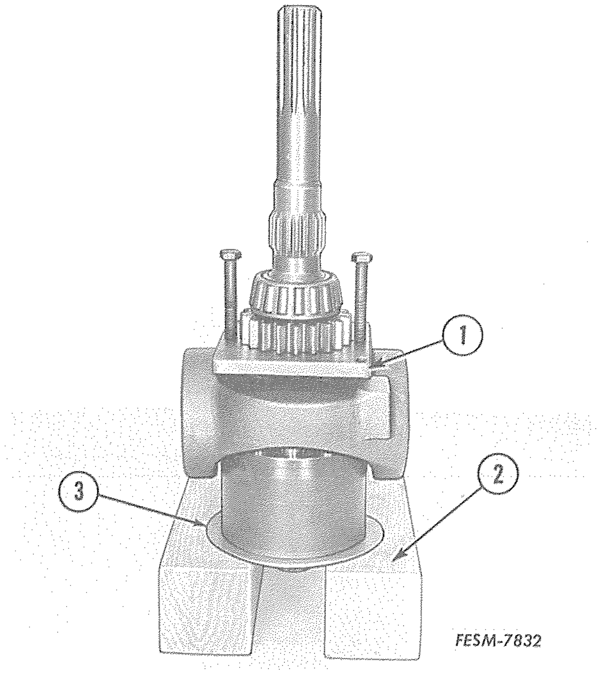

Ball guide
Wide tooth
Ground off teeth
Slipper retainer springs
Cylinder block
FESM-389A

1. Assemble the pump cylinder block with the springs, bail guide in place and the ball guide properly timed.


1
2
3
4
5
6
FESM-7833

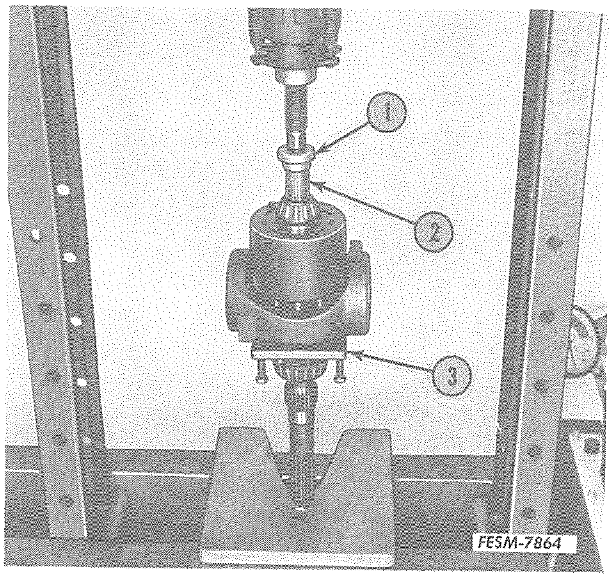
2. Using a protective cover on the wood block, assemble the pistons with slipper retainer.

1. Thrust plate
2. Pump cylinder block
3. Input shaft
4. FES 123-3 horseshoe tool
5. FES 123-9 center section surface protector
6. Pump swash plate housing



1. FES 123-3 tool
2. Wooden blocks
3. FES 123-9 center section protector

3. Thoroughly lubricate the piston slippers with Hy-Tran and place the swash plate on top of them. Install the horseshoe tool with the opening opposite the attaching ears on the swash plate and install the shaft making certain that is properly timed.

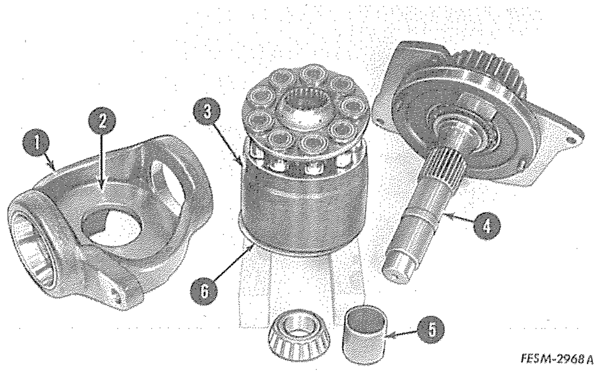


1. Step plate
2. 3/4" socket
3. Horseshoe tool FES 123-3

4. Place the spring guide over the end of the shaft and press the rear bearing into place using a 3/4 inch socket and step plate.

IMPORTANT: THE SPRING GUIDE MUST GO FAR ENOUGH DOWN INTO PLACE TO ALLOW THE BEARING TO BE PRESSED TIGHTLY AGAINST ITS SHOULDER IN ORDER TO HAVE PROPER PRELOAD.

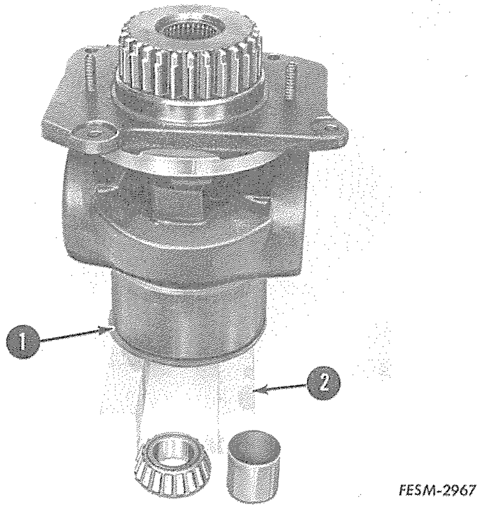
Hydrostatic Motor



1. Motor swash plate
2. Motor thrust plate
3. Motor block
4. Motor (output) shaft
5. Spring guide

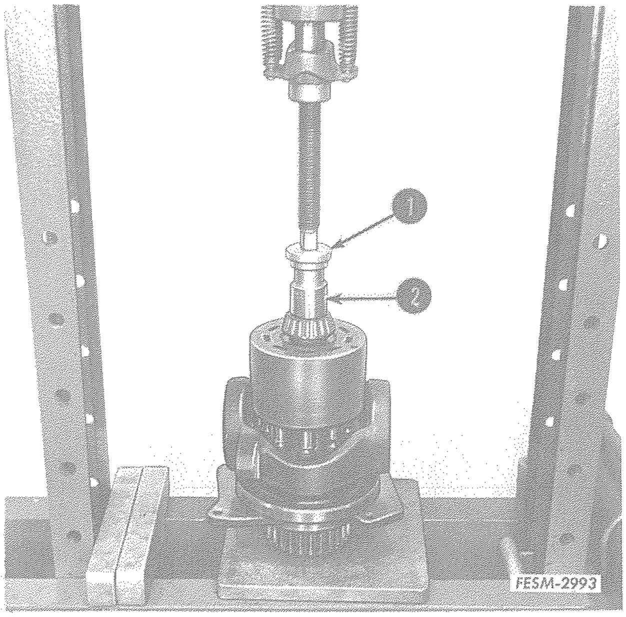
1. Place the motor cylinder block on a protective cover and assemble the springs and ball guide.

2. Place the pistons and slipper retainer assembly into the cylinder block.



1. FES 123-9 center section surface protector
2. Wood blocks

3. Place the motor shaft assembly through the cylinder block with the shaft properly timed.

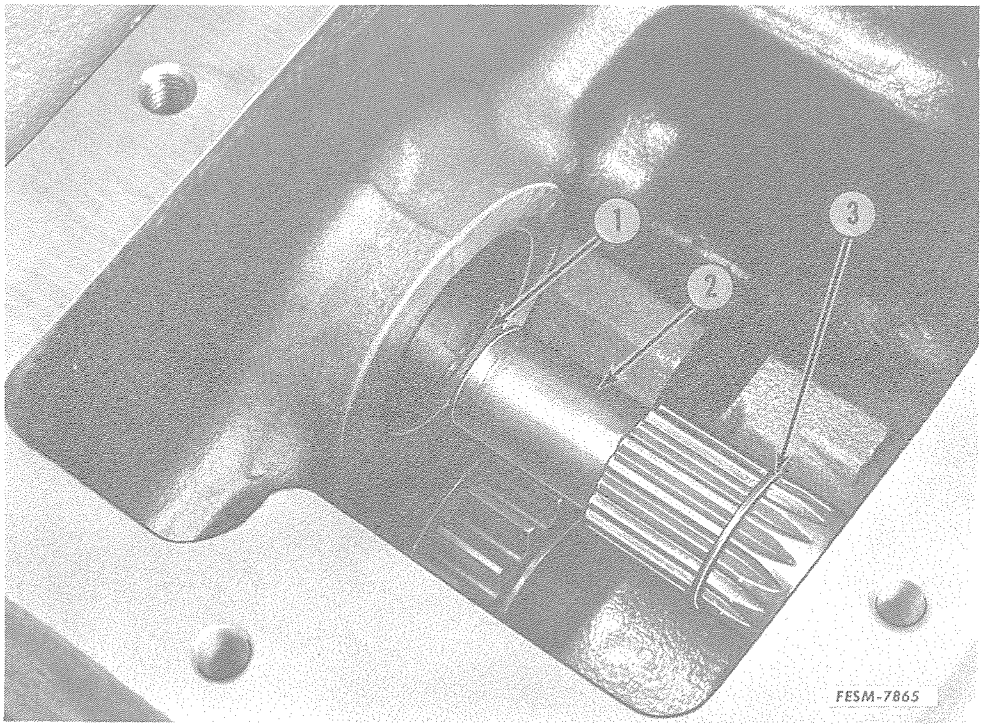


4. Insert the spring guide and press the front bearing in against its shoulder using a 1-1/8" socket and step plate.

IMPORTANT: BE SURE THAT THE SPRING GUIDE HAS BEEN INSERTED FAR ENOUGH AND THAT THE SHAFT IS IN AS FAR AS IT WILL GO BEFORE PRESSING THE BEARING INTO PLACE.

1. Step plate
2. 1-1/8" socket

IPTO Installation and Bearing Adjustment

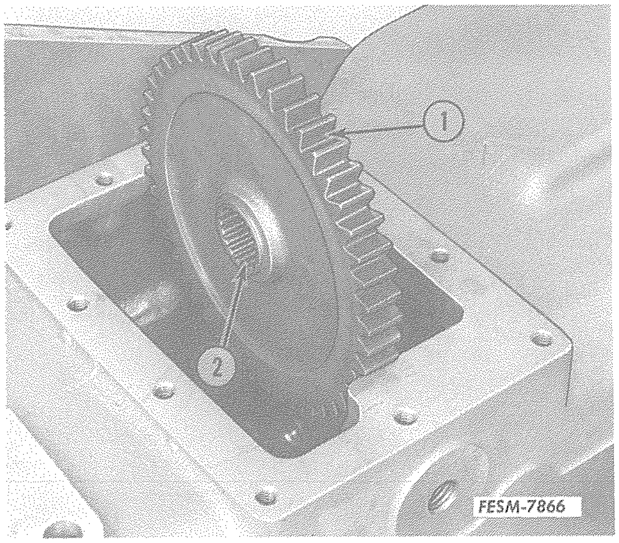


1. Bearing retaining housing ring
2. IPTO shaft
3. Gear retaining ring

1. Rotate housing so IPTO shaft can be installed with rear frame up.

2. Install bearing retaining housing ring if removed.

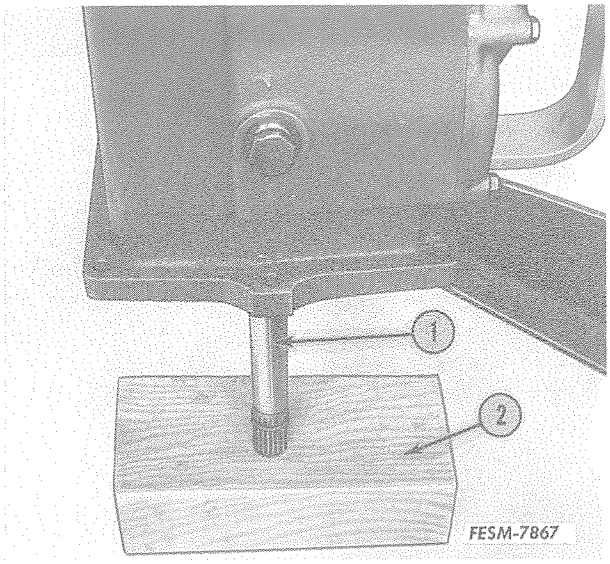
3. Put IPTO shaft through the seal carefully and install the gear retaining ring.



4. Slide the shaft through, being careful of seal while installing IPTO driven gear.

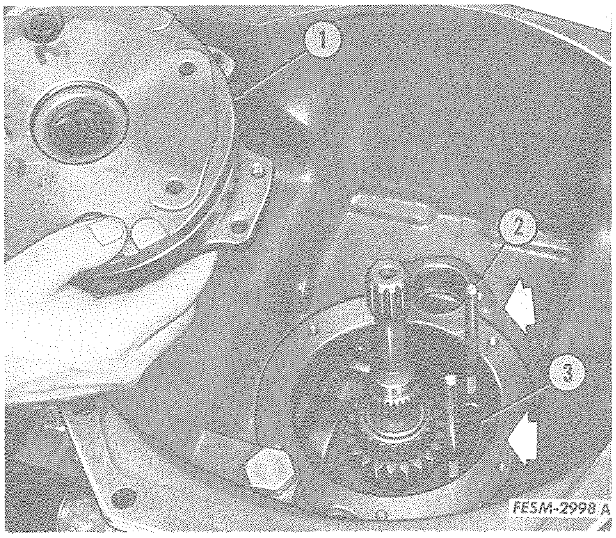
5. As shown in illustration with machined hub face toward the front so IPTO gear will contact the cone face.

1. Gear
2. Machined surface



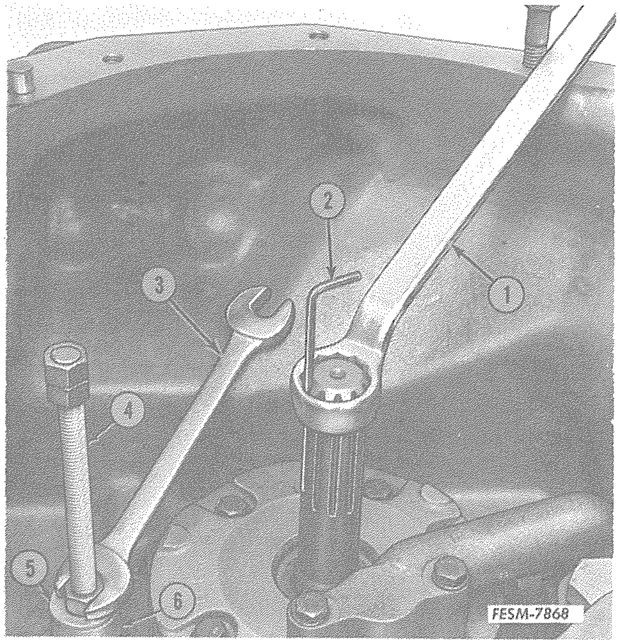
6. Rotate housing up and support shaft on wooden block as shown in illustration.

1. IPTO shaft
2. Wooden block



7. Using two 6" x 3/8" NC dowel pins install them into suction pipe elbow so charge pump can be installed.

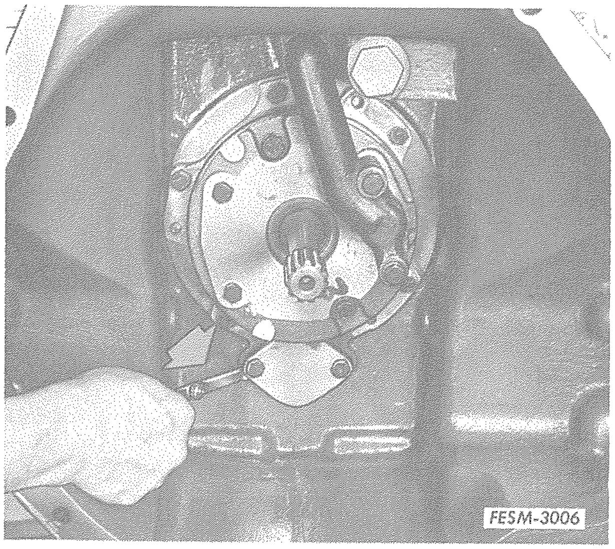
1. Charge pump
2. 6" x 3/8" NC. dowel pins
3. Suction pipe elbow



1. 1-1/8" wrench
2. Allen wrench
3. 9/16" opened end wrench
4. 6" x 1/2" NC capscrews with full treads
5. Heavy washer
6. Spacer

8. Using a new O-ring and petrolem jelly install charge pump. Make sure splines on both pump and shaft are matched. Use 1-1/8" socket and insert Allen wrench between socket and shaft to align the splines so charge pump will properly seat. If pump will not seat, using a screw driver between the housing and suction tube pry over the suction pipe elbow.

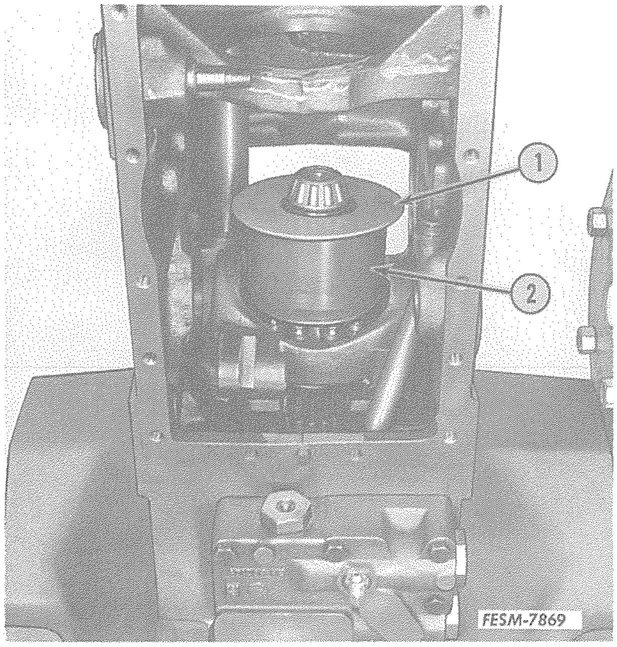
NOTE: Torque the special Nylock cap screws with copper washers to 35 ft. lbs. using 1-1/8" box wrench and Allen wrench to hold IPTO shaft from turning. Install the rear cup and cone onto the shaft, using a spacer and a 6" x 1/2" NC capscrew with full treads. Retain the IPTO shaft from turning. Tighten 1/2" nut to seat related parts.



9. Adjust bearings preload by installing master spacer FES-123-11 under front IPTO bearing cover and torque the 2 capscrews to 20 in. lbs. while rotating the input shaft, stop rotating shaft and torque to 35 in. lbs. Measure spacer between frame and cover and subtract the average gap from .245 to get the correct spacer. Remove the cap and master ring, add the correct spacer ± .002" and torque capscrews to 35 ft. lbs. Refer to parts book for proper spacer required.

TRANSMISSION REASSEMBLY

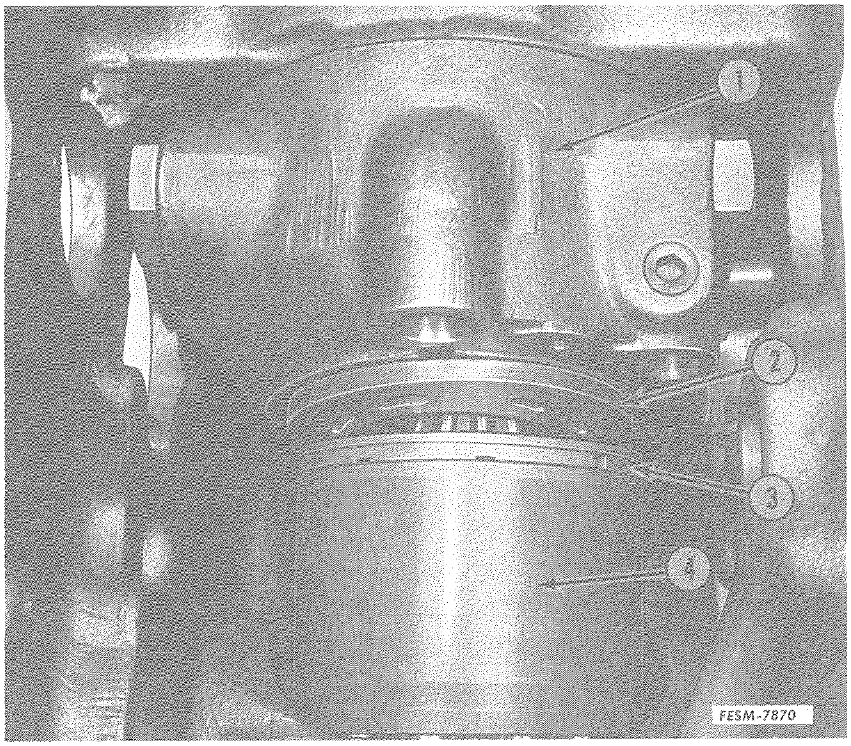
Hydrostatic Pump



1. Use petroleum jelly on the cylinder block and install the dowel and centering ring and place the bearing plate over the dowel and centering ring. Be sure that parts mate up properly and that the bearing plate is stuck tightly to the cylinder block.

2. Install the pump assembly into the housing with the bell end down and let the assembly rest against the bottom of the case.

1. FES 123-9 surface protector
2. Pump



1. Center section
2. Valve plate
3. Bearing plate
4. Pump

3. Install the dowel into center section and cover the center section liberally with petroleum jelly and stick the valve plate to it tightly.

NOTE: Be sure inner-race is installed in center section.

4. Using your hand grip shaft tightly and rotate housing to a horizontal position and place center section with valve plate into position and insert bolts. Torque them to 110 ft. lbs.

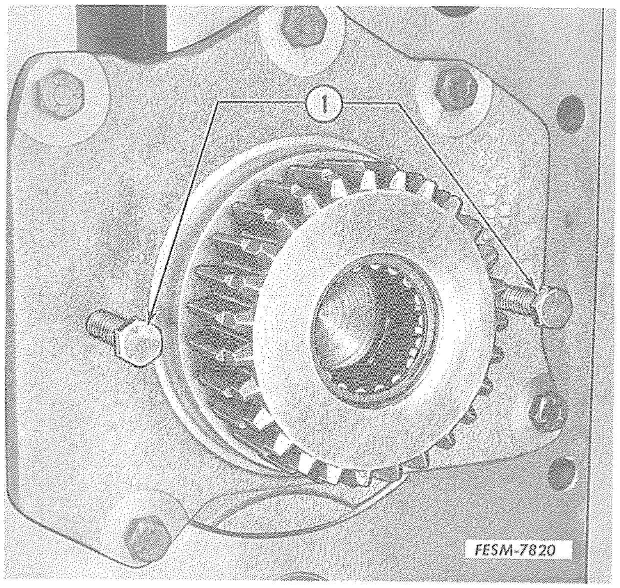
IMPORTANT: USE EXTREME CARE HERE TO KEEP FROM SCRATCHING ANY OF THE HIGHLY MACHINED SURFACES OR DISTURBING THE POSITIONS OF THE VALVE OR BEARING PLATES.

5. Carefully adjust the screws in the horseshoe tool to get the trunnion cups lined up so that the trunnion bearings may be installed without tipping the pump assembly.

6. Using new O-rings and petroleum jelly to protect them, install the trunnion bearings using the proper shim pack as previously determined.

7. Remove the horseshoe tool and carefully examine the valve and bearing plates to make certain that they are still in proper position.

Hydrostatic Motor



1. Capscrews

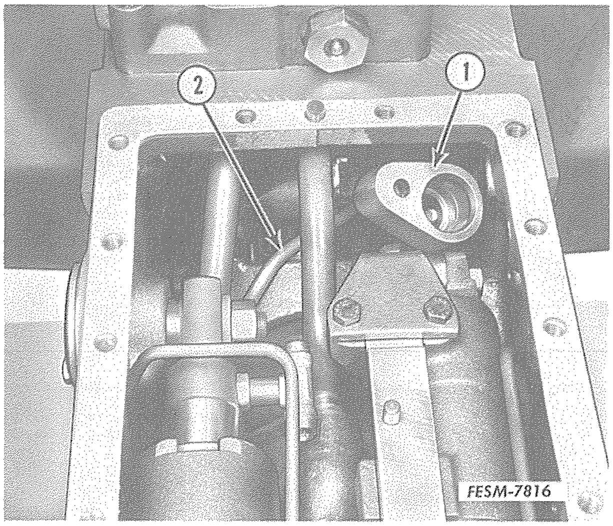
1. Install the previously assembled motor assembly into the housing and tighten the 5 capscrews to where they are finger tight.

2. With the housing rotated to where the bell housing is down, torque the 5 capscrews to 35 ft. lbs. and adjust the setscrews to where the cups in the swash plate are properly lined up for bearing installation.

NOTE: IT MAY BE NECESSARY TO PRY SLIGHTLY AGAINST THE EAR OF THE SWASH PLATE TO ROTATE THE MOTOR ASSEMBLY. THIS ASSEMBLY CAN BE FACILITATED BY OMITTING TRUNNION SHIMS AND O-RINGS AND ADJUSTING THE SWASH PLATE SCREWS UNTIL THE TRUNNIONS CAN BE SLIPPED IN AND OUT EASILY. THEN REMOVE ONE AND PUT ON THE O-RING AND SHIMS AND THEN INSTALL THE BOLTS. REMOVE THE OTHER AND ADD THE O-RING AND INSTALL THE BOLTS AND TORQUE TO 35 FT. LBS. THESE BOLTS ARE SPECIAL BOLTS WITH A NYLOCK INSERT TO PREVENT LEAKING.

3. Remove the special setscrews.

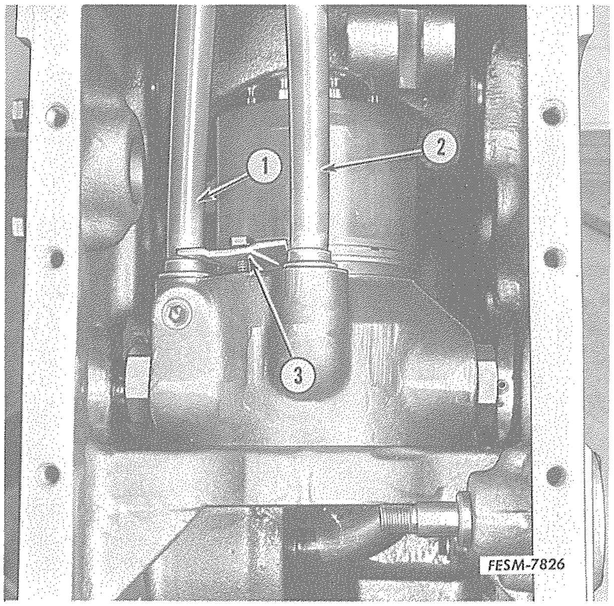
Servo Regulator



Before installing the servo regulator body and valve be sure the teflon seal is in the regulator body use petroleum jelly to assist. Torque valve to 18 ft. lbs. being careful not to bend servo supply tube.

1. Servo regulator body
2. Servo supply tube

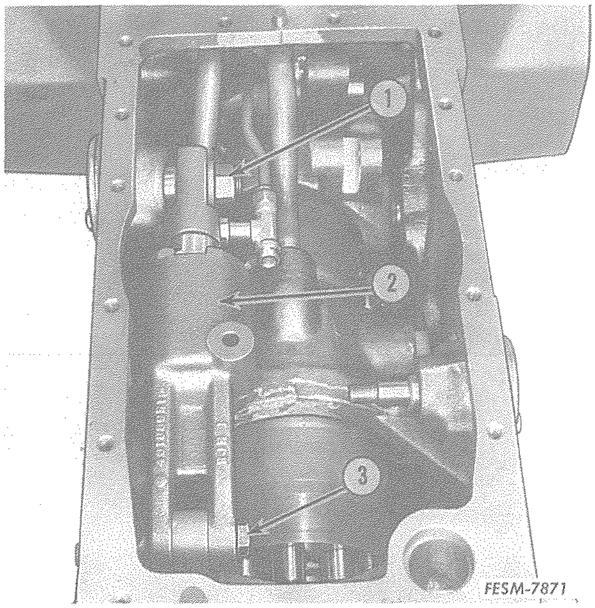
Charge Pump and Return Tubes



Install the charge supply and charge return tubes in place using new teflon seals and securing them with the special clip which secures them to the center section.

1. Center section exhaust tube
2. Center section charge tube
3. Center section pipe retainer strip

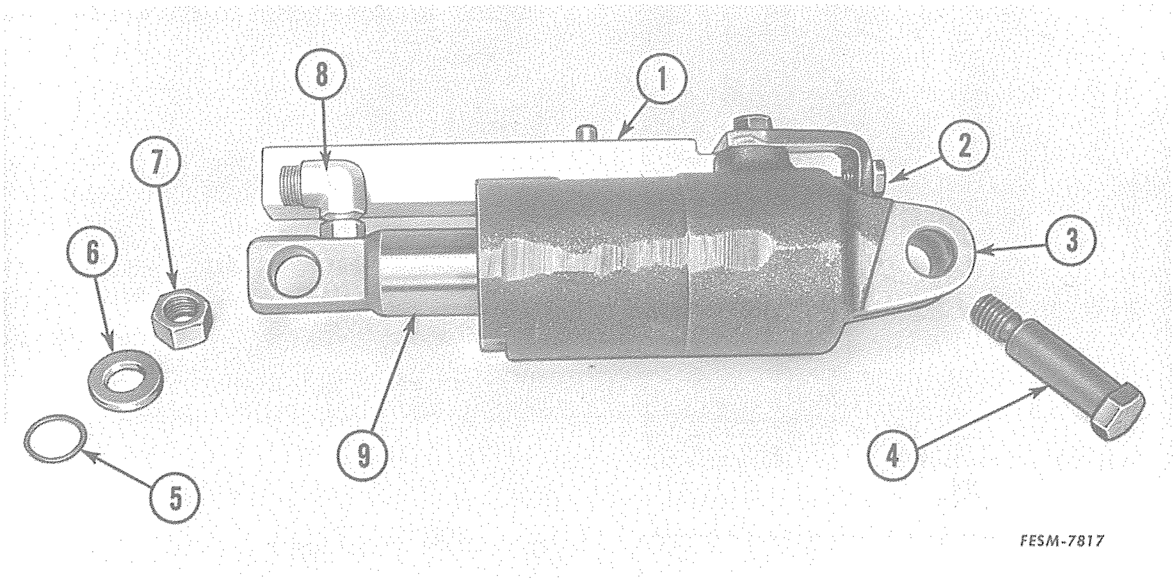
Motor Servo



Install the motor servo using a new O-ring. Torque the rear anchor bolt to 85 ft. lbs. Install the trunnion shaft washer and nut and torque to 42 ft. lbs.

1. Anchor bolt
2. Motor servo cylinder
3. Shoulder bolt

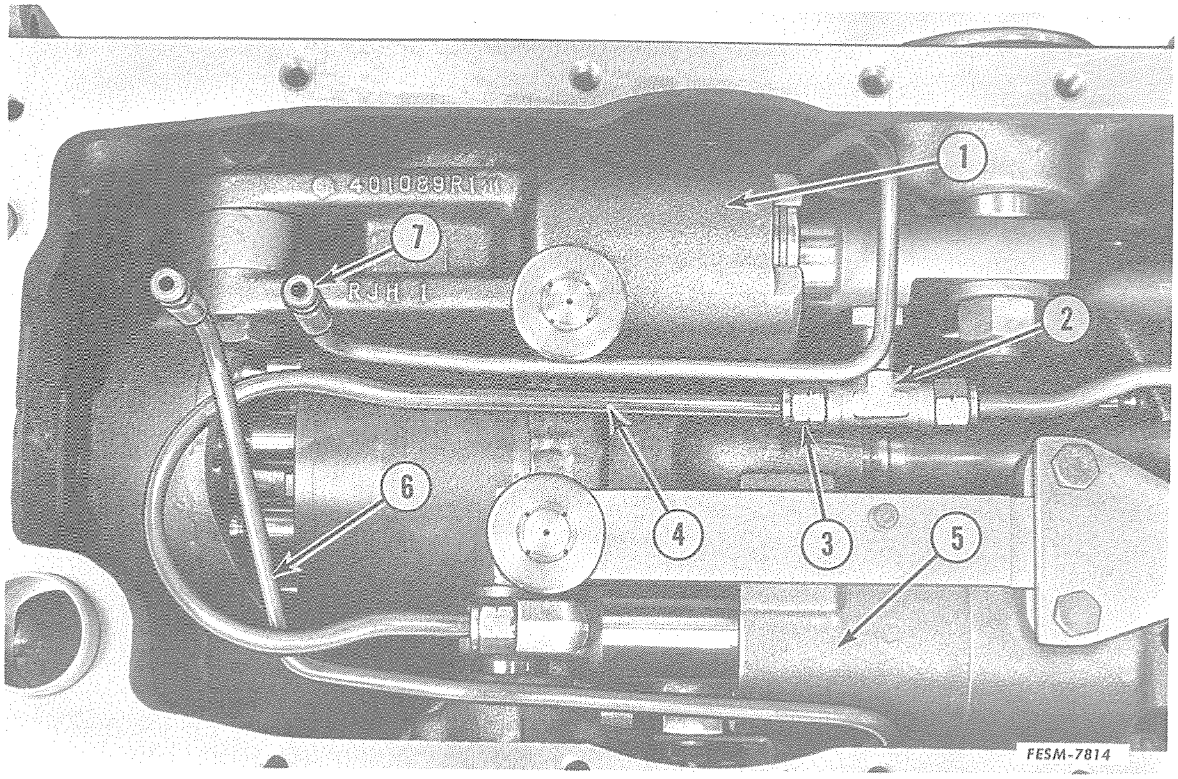
Pump Servo



Servo cylinder.

Install the pump servo cylinder and torque the bolt on the swash plate end to 42 ft. lbs. Place the wavy washer against the cylinder rod using petroleum jelly to make certain that it does not slip down on the small portion of the shaft. Install the heavy washer and tighten the nut to 42 ft. lbs.

Servo Supply Tube



1. Motor servo cylinder
2. Motor servo supply tee
3. Jam nut
4. Pump servo supply tube
5. Pump servo cylinder
6. Reverse high psi tube
7. Forward high psi tube

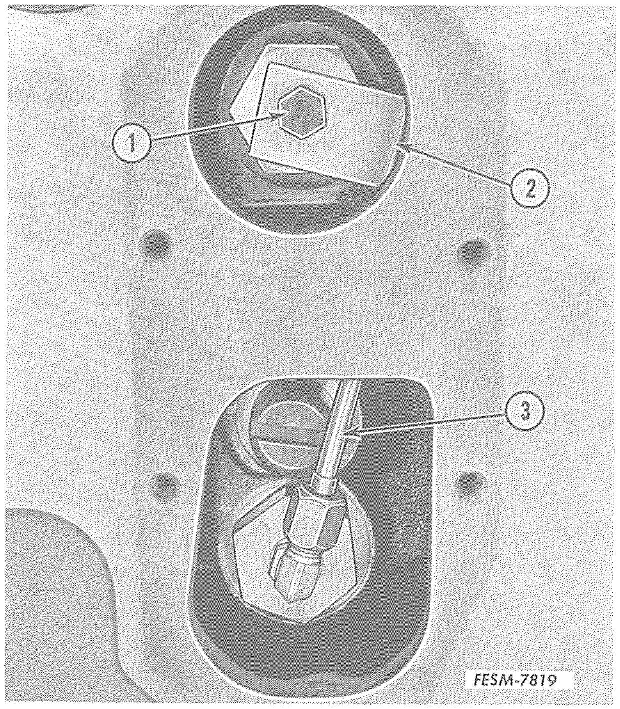
Install high pressure lines and then the servo supply tube. Tighten servo supply tube fittings until the nut bottoms on shoulder all fittings.

NOTE: Tighten the servo regulator valve carefully to 18 foot pounds holding the body to prevent it from rotating and bending the tube. Place the cover, with the jumper tube O-ring remove into position making certain that the bolt holes will line up with the cover in place. If not, remove the cover and reposition the valve body. Install the O-ring and cover.

Check Valves and Check Valve Plugs

Install the check valves and the check valve plugs in center section. Torque to 50 ft. lbs.

High Pressure Lines

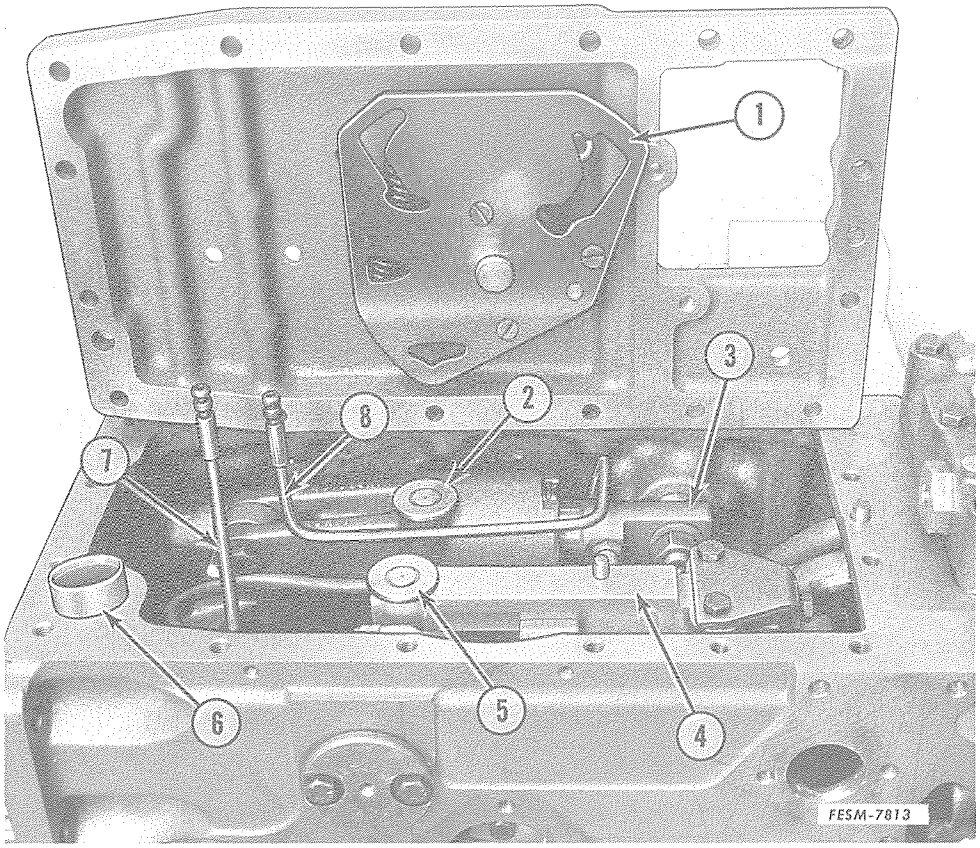


1. Capscrew
2. Clip
3. Reverse high psi line

Install the high pressure lines to center section and secure with clips provided.

CAUTION: Hydrostatic lines are not to be replaced with high pressure hydraulic hose. A high pressure hydraulic hose with 8,000 psi burst rating will have an approximate 2,000 psi working pressure rating. This is not acceptable for a hydrostatic system.

TOP COVER WITH CONTROL CAM



1. Control cam assembly
2. Motor cylinder control orifice
3. Motor servo cylinder
4. Adjusting block
5. Pump cylinder control orifice
6. Over flow pipe
7. Reverse high pressure tube
8. Forward high pressure tube

NOTE: Before installing top cover install the variable orifices in both the pump and motor servo cylinders. Install the spring washers with dished side toward the body of the orifice valve.

Install remaining cover plates paying particular attention to the placement of short capscrews with copper washers as covered in disassembly.